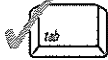




Checklist for Stormwater Report

A. Introduction

Important: When filling out forms on the computer, use only the tab key to move your cursor - do not use the return key.



A Stormwater Report must be submitted with the Notice of Intent permit application to document compliance with the Stormwater Management Standards. The following checklist is NOT a substitute for the Stormwater Report (which should provide more substantive and detailed information) but is offered here as a tool to help the applicant organize their Stormwater Management documentation for their Report and for the reviewer to assess this information in a consistent format. As noted in the Checklist, the Stormwater Report must contain the engineering computations and supporting information set forth in Volume 3 of the Massachusetts Stormwater Handbook. The Stormwater Report must be prepared and certified by a Registered Professional Engineer (RPE) licensed in the Commonwealth.

The Stormwater Report must include:

- The Stormwater Checklist completed and stamped by a Registered Professional Engineer (see page 2) that certifies that the Stormwater Report contains all required submittals.¹ This Checklist is to be used as the cover for the completed Stormwater Report.
- Applicant/Project Name
- Project Address
- Name of Firm and Registered Professional Engineer that prepared the Report
- Long-Term Pollution Prevention Plan required by Standards 4-6
- Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan required by Standard 8²
- Operation and Maintenance Plan required by Standard 9

In addition to all plans and supporting information, the Stormwater Report must include a brief narrative describing stormwater management practices, including environmentally sensitive site design and LID techniques, along with a diagram depicting runoff through the proposed BMP treatment train. Plans are required to show existing and proposed conditions, identify all wetland resource areas, NRCS soil types, critical areas, Land Uses with Higher Potential Pollutant Loads (LUHPPL), and any areas on the site where infiltration rate is greater than 2.4 inches per hour. The Plans shall identify the drainage areas for both existing and proposed conditions at a scale that enables verification of supporting calculations.

As noted in the Checklist, the Stormwater Management Report shall document compliance with each of the Stormwater Management Standards as provided in the Massachusetts Stormwater Handbook. The soils evaluation and calculations shall be done using the methodologies set forth in Volume 3 of the Massachusetts Stormwater Handbook.

¹ The Stormwater Report may also include the Illicit Discharge Compliance Statement required by Standard 10. If not included in the Stormwater Report, the Illicit Discharge Compliance Statement must be submitted prior to the discharge of stormwater runoff to the post-construction best management practices.

² For some complex projects, it may not be possible to include the Construction Period Erosion and Sedimentation Control Plan in the Stormwater Report. In that event, the issuing authority has the discretion to issue an Order of Conditions that approves the project and includes a condition requiring the proponent to submit the Construction Period Erosion and Sedimentation Control Plan before commencing any land disturbance activity on the site.

B. Stormwater Checklist and Certification

The following checklist is intended to serve as a guide for applicants as to the elements that ordinarily need to be addressed in a complete Stormwater Report. The checklist is also intended to provide



Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands Program

Checklist for Stormwater Report

conservation commissions and other reviewing authorities with a summary of the components necessary for a comprehensive Stormwater Report that addresses the ten Stormwater Standards.

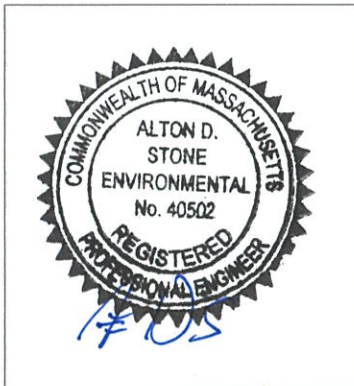
Note: Because stormwater requirements vary from project to project, it is possible that a complete Stormwater Report may not include information on some of the subjects specified in the Checklist. If it is determined that a specific item does not apply to the project under review, please note that the item is not applicable (N.A.) and provide the reasons for that determination.

A complete checklist must include the Certification set forth below signed by the Registered Professional Engineer who prepared the Stormwater Report.

Registered Professional Engineer's Certification

I have reviewed the Stormwater Report, including the soil evaluation, computations, Long-term Pollution Prevention Plan, the Construction Period Erosion and Sedimentation Control Plan (if included), the Long-term Post-Construction Operation and Maintenance Plan, the Illicit Discharge Compliance Statement (if included) and the plans showing the stormwater management system, and have determined that they have been prepared in accordance with the requirements of the Stormwater Management Standards as further elaborated by the Massachusetts Stormwater Handbook. I have also determined that the information presented in the Stormwater Checklist is accurate and that the information presented in the Stormwater Report accurately reflects conditions at the site as of the date of this permit application.

Registered Professional Engineer Block and Signature



Alton D. Stone
Signature and Date

09-24-2021

Checklist

Project Type: Is the application for new development, redevelopment, or a mix of new and redevelopment?

- ☐ New development
- ☒ Redevelopment
- ☐ Mix of New Development and Redevelopment

Checklist (continued)

LID Measures: Stormwater Standards require LID measures to be considered. Document what environmentally sensitive design and LID Techniques were considered during the planning and design of



Checklist for Stormwater Report

the project:

- ☒ No disturbance to any Wetland Resource Areas
- ☐ Site Design Practices (e.g. clustered development, reduced frontage setbacks)
- ☐ Reduced Impervious Area (Redevelopment Only)
- ☒ Minimizing disturbance to existing trees and shrubs
- ☐ LID Site Design Credit Requested:
 - ☐ Credit 1
 - ☐ Credit 2
 - ☐ Credit 3
- ☐ Use of "country drainage" versus curb and gutter conveyance and pipe
- ☐ Bioretention Cells (includes Rain Gardens)
- ☐ Constructed Stormwater Wetlands (includes Gravel Wetlands designs)
- ☐ Treebox Filter
- ☒ Water Quality Swale
- ☐ Grass Channel
- ☐ Green Roof
- ☐ Other (describe): _____

Standard 1: No New Untreated Discharges

- ☒ No new untreated discharges
- ☒ Outlets have been designed so there is no erosion or scour to wetlands and waters of the Commonwealth
- ☒ Supporting calculations specified in Volume 3 of the Massachusetts Stormwater Handbook included.

Checklist (continued)

Standard 2: Peak Rate Attenuation



Checklist for Stormwater Report

- ☐ Standard 2 waiver requested because the project is located in land subject to coastal storm flowage and stormwater discharge is to a wetland subject to coastal flooding.
- ☒ Evaluation provided to determine whether off-site flooding increases during the 100-year 24-hour storm.
- ☒ Calculations provided to show that post-development peak discharge rates do not exceed pre-development rates for the 2-year and 10-year 24-hour storms. If evaluation shows that off-site flooding increases during the 100-year 24-hour storm, calculations are also provided to show that post-development peak discharge rates do not exceed pre-development rates for the 100-year 24-hour storm.

Standard 3: Recharge

- ☐ Soil Analysis provided.
- ☐ Required Recharge Volume calculation provided.
- ☐ Required Recharge volume reduced through use of the LID site Design Credits.
- ☐ Sizing the infiltration, BMPs is based on the following method: Check the method used.
 - ☒ Static
 - ☐ Simple Dynamic
 - ☐ Dynamic Field¹
- ☐ Runoff from all impervious areas at the site discharging to the infiltration BMP.
- ☐ Runoff from all impervious areas at the site is *not* discharging to the infiltration BMP and calculations are provided showing that the drainage area contributing runoff to the infiltration BMPs is sufficient to generate the required recharge volume.
- ☐ Recharge BMPs have been sized to infiltrate the Required Recharge Volume.
- ☒ Recharge BMPs have been sized to infiltrate the Required Recharge Volume *only* to the maximum extent practicable for the following reason:
 - ☐ Site is comprised solely of C and D soils and/or bedrock at the land surface
 - ☐ M.G.L. c. 21E sites pursuant to 310 CMR 40.0000
 - ☐ Solid Waste Landfill pursuant to 310 CMR 19.000
 - ☐ Project is otherwise subject to Stormwater Management Standards only to the maximum extent practicable.
- ☒ Calculations showing that the infiltration BMPs will drain in 72 hours are provided.
- ☐ Property includes a M.G.L. c. 21E site or a solid waste landfill and a mounding analysis is included.

¹ 80% TSS removal is required prior to discharge to infiltration BMP if Dynamic Field method is used.

Checklist (continued)

Standard 3: Recharge (continued)



Checklist for Stormwater Report

- ☐ The infiltration BMP is used to attenuate peak flows during storms greater than or equal to the 10-year 24-hour storm and separation to seasonal high groundwater is less than 4 feet and a mounding analysis is provided.
- ☒ Documentation is provided showing that infiltration BMPs do not adversely impact nearby wetland resource areas.

Standard 4: Water Quality

The Long-Term Pollution Prevention Plan typically includes the following:

- Good housekeeping practices;
 - Provisions for storing materials and waste products inside or under cover;
 - Vehicle washing controls;
 - Requirements for routine inspections and maintenance of stormwater BMPs;
 - Spill prevention and response plans;
 - Provisions for maintenance of lawns, gardens, and other landscaped areas;
 - Requirements for storage and use of fertilizers, herbicides, and pesticides;
 - Pet waste management provisions;
 - Provisions for operation and management of septic systems;
 - Provisions for solid waste management;
 - Snow disposal and plowing plans relative to Wetland Resource Areas;
 - Winter Road Salt and/or Sand Use and Storage restrictions;
 - Street sweeping schedules;
 - Provisions for prevention of illicit discharges to the stormwater management system;
 - Documentation that Stormwater BMPs are designed to provide for shutdown and containment in the event of a spill or discharges to or near critical areas or from LUHPPL;
 - Training for staff or personnel involved with implementing Long-Term Pollution Prevention Plan;
 - List of Emergency contacts for implementing Long-Term Pollution Prevention Plan.
- ☒ A Long-Term Pollution Prevention Plan is attached to Stormwater Report and is included as an attachment to the Wetlands Notice of Intent.
 - ☐ Treatment BMPs subject to the 44% TSS removal pretreatment requirement and the one inch rule for calculating the water quality volume are included, and discharge:
 - ☐ is within the Zone II or Interim Wellhead Protection Area
 - ☐ is near or to other critical areas
 - ☐ is within soils with a rapid infiltration rate (greater than 2.4 inches per hour)
 - ☐ involves runoff from land uses with higher potential pollutant loads.
 - ☐ The Required Water Quality Volume is reduced through use of the LID site Design Credits.
 - ☐ Calculations documenting that the treatment train meets the 80% TSS removal requirement and, if applicable, the 44% TSS removal pretreatment requirement, are provided.

Checklist (continued)

Standard 4: Water Quality (continued)



Checklist for Stormwater Report

- ☐ The BMP is sized (and calculations provided) based on:
 - ☐ The ½" or 1" Water Quality Volume or
 - ☐ The equivalent flow rate associated with the Water Quality Volume and documentation is provided showing that the BMP treats the required water quality volume.
- ☐ The applicant proposes to use proprietary BMPs, and documentation supporting use of proprietary BMP and proposed TSS removal rate is provided. This documentation may be in the form of the propriety BMP checklist found in Volume 2, Chapter 4 of the Massachusetts Stormwater Handbook and submitting copies of the TARP Report, STEP Report, and/or other third party studies verifying performance of the proprietary BMPs.
- ☐ A TMDL exists that indicates a need to reduce pollutants other than TSS and documentation showing that the BMPs selected are consistent with the TMDL is provided.

Standard 5: Land Uses With Higher Potential Pollutant Loads (LUHPPLs)

- ☐ The NPDES Multi-Sector General Permit covers the land use and the Stormwater Pollution Prevention Plan (SWPPP) has been included with the Stormwater Report.
- ☐ The NPDES Multi-Sector General Permit covers the land use and the SWPPP will be submitted *prior to* the discharge of stormwater to the post-construction stormwater BMPs.
- ☐ The NPDES Multi-Sector General Permit does *not* cover the land use.
- ☐ LUHPPLs are located at the site and industry specific source control and pollution prevention measures have been proposed to reduce or eliminate the exposure of LUHPPLs to rain, snow, snow melt and runoff, and been included in the long term Pollution Prevention Plan.
- ☐ All exposure has been eliminated.
- ☐ All exposure has *not* been eliminated and all BMPs selected are on MassDEP LUHPPL list.
- ☐ The LUHPPL has the potential to generate runoff with moderate to higher concentrations of oil and grease (e.g. all parking lots with >1000 vehicle trips per day) and the treatment train includes an oil grit separator, a filtering bioretention area, a sand filter or equivalent.

Standard 6: Critical Areas

- ☐ The discharge is near or to a critical area and the treatment train includes only BMPs that MassDEP has approved for stormwater discharges to or near that particular class of critical area.
- ☐ Critical areas and BMPs are identified in the Stormwater Report.

Checklist (continued)

Standard 7: Redevelopments and Other Projects Subject to the Standards only to the maximum extent practicable



Checklist for Stormwater Report

-
- ☒ The project is subject to the Stormwater Management Standards only to the maximum Extent Practicable as a:
- ☐ Limited Project
 - ☐ Small Residential Projects: 5-9 single family houses or 5-9 units in a multi-family development provided there is no discharge that may potentially affect a critical area.
 - ☐ Small Residential Projects: 2-4 single family houses or 2-4 units in a multi-family development with a discharge to a critical area
 - ☐ Marina and/or boatyard provided the hull painting, service and maintenance areas are protected from exposure to rain, snow, snow melt and runoff
 - ☐ Bike Path and/or Foot Path
 - ☒ Redevelopment Project
 - ☐ Redevelopment portion of mix of new and redevelopment.
- ☐ Certain standards are not fully met (Standard No. 1, 8, 9, and 10 must always be fully met) and an explanation of why these standards are not met is contained in the Stormwater Report.
- ☒ The project involves redevelopment and a description of all measures that have been taken to improve existing conditions is provided in the Stormwater Report. The redevelopment checklist found in Volume 2 Chapter 3 of the Massachusetts Stormwater Handbook may be used to document that the proposed stormwater management system (a) complies with Standards 2, 3 and the pretreatment and structural BMP requirements of Standards 4-6 to the maximum extent practicable and (b) improves existing conditions.

Standard 8: Construction Period Pollution Prevention and Erosion and Sedimentation Control

A Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan must include the following information:

- Narrative;
 - Construction Period Operation and Maintenance Plan;
 - Names of Persons or Entity Responsible for Plan Compliance;
 - Construction Period Pollution Prevention Measures;
 - Erosion and Sedimentation Control Plan Drawings;
 - Detail drawings and specifications for erosion control BMPs, including sizing calculations;
 - Vegetation Planning;
 - Site Development Plan;
 - Construction Sequencing Plan;
 - Sequencing of Erosion and Sedimentation Controls;
 - Operation and Maintenance of Erosion and Sedimentation Controls;
 - Inspection Schedule;
 - Maintenance Schedule;
 - Inspection and Maintenance Log Form.
- ☒ A Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan containing the information set forth above has been included in the Stormwater Report.

Checklist (continued)

Standard 8: Construction Period Pollution Prevention and Erosion and Sedimentation Control (continued)



Checklist for Stormwater Report

- ☐ The project is highly complex and information is included in the Stormwater Report that explains why it is not possible to submit the Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan with the application. A Construction Period Pollution Prevention and Erosion and Sedimentation Control has **not** been included in the Stormwater Report but will be submitted **before** land disturbance begins.
- ☒ The project is **not** covered by a NPDES Construction General Permit.
- ☐ The project is covered by a NPDES Construction General Permit and a copy of the SWPPP is in the Stormwater Report.
- ☐ The project is covered by a NPDES Construction General Permit but no SWPPP been submitted. The SWPPP will be submitted BEFORE land disturbance begins.

Standard 9: Operation and Maintenance Plan

- ☒ The Post Construction Operation and Maintenance Plan is included in the Stormwater Report and includes the following information:
 - ☒ Name of the stormwater management system owners;
 - ☒ Party responsible for operation and maintenance;
 - ☒ Schedule for implementation of routine and non-routine maintenance tasks;
 - ☒ Plan showing the location of all stormwater BMPs maintenance access areas;
 - ☒ Description and delineation of public safety features;
 - ☐ Estimated operation and maintenance budget; and
 - ☒ Operation and Maintenance Log Form.
- ☐ The responsible party is **not** the owner of the parcel where the BMP is located and the Stormwater Report includes the following submissions:
 - ☐ A copy of the legal instrument (deed, homeowner's association, utility trust or other legal entity) that establishes the terms of and legal responsibility for the operation and maintenance of the project site stormwater BMPs;
 - ☐ A plan and easement deed that allows site access for the legal entity to operate and maintain BMP functions.

Standard 10: Prohibition of Illicit Discharges

- ☒ The Long-Term Pollution Prevention Plan includes measures to prevent illicit discharges;
- ☐ An Illicit Discharge Compliance Statement is attached;
- ☒ NO Illicit Discharge Compliance Statement is attached but will be submitted **prior to** the discharge of any stormwater to post-construction BMPs.

ALTON ENGINEERING

Hydrologic - Water Resources – Environmental – Site Design & Permitting – Wetland Sciences

Alton Day Stone, PE, LSP, ASE

Registered Professional Engineer, Licensed Site Professional, Approved Soil Evaluator

10 Rugg Road, Sterling, MA 01564

Phone: 978.660.7728 Email: altonengineering@gmail.com

STORMWATER DRAINAGE REPORT [Attachment to the Stormwater Check List]

1089 MILLBURY STREET – WORCESTER, MASSACHUSETTS

**Prepared For: Gold Star Builders
6 Jacques Road – Worcester, Massachusetts**

September 24, 2021

This Stormwater Drainage Report has been prepared for the proposed restoration of the 1087 & 1089 properties (the Site) located in Worcester, Massachusetts. The Report is required pursuant to the Department of Environmental Protection (DEP) *Stormwater Checklist*. Activities at the Site are not subject to the DEP *Stormwater Handbook – Stormwater Management Standards*. However, the Worcester Conservation Commission has required that activities conducted at the Site be in compliance with the DEP Standards.

Project Description

The Site is developed with one duplex (two units) with an associated paved driveway. The project is categorized as Redevelopment because no actual new development is proposed. Proposed activities are only for restoration of altered areas and to construct Best Management Practices (BMP) to manage stormwater runoff.

Re-Development features are shown on the enclosed *Proposed Lawn Drainage Plan 1987-1089 Millbury Street Worcester, Massachusetts* (the Plan) prepared by D. J. & Associates (Clinton, MA) dated September 21, 2021.

The Site is 35,229 sf in area. For design and descriptive purposes the Site has been divided into Upper and Lower Sections.

- Upper Section – the area upslope of the Recharging Pipe (stormwater collection) that was altered by earth removal in 2021. This Section is steeply sloped – e.g. 2:1+ - westward towards Millbury Street. The majority of earthwork, slope stabilization and stormwater runoff control will be conducted in this area.

Due to the Site geology – fractured bedrock and steep earthen bank - much of the “runoff” is not derived directly by rainfall. Rather, it is generated by the outbreak of groundwater

seepage and springs discharging from the fractured bedrock and soil bank. These conditions provide a near constant discharge of runoff.

- Lower Section – the downslope remainder of the Site bordering on Millbury Street that has been developed; one residential duplex (two units - total impervious = 1,824 sf) with associated paved driveway (total impervious = 2,145± sf). This section of the Site also slopes westward to Millbury Street, however the slope is moderate – 3:1± and the Section is stable. However, limited restoration – loam & seeding) will be conducted on this Section.
- In 2021 approximately 9,900 sf of the Upper Section were altered by earth removal without permits. The alteration resulted in removal of wooded vegetation, steep slopes – 1:1±, exposure of raw earth, significant stormwater runoff and groundwater seepage discharge, and the associated erosion.

Proposed Restoration Activities – Upper Section

- Boulder Rip-Rap. A section of the excavation area where the slopes are steepest and unstable, groundwater seepage discharge and runoff velocity are at maximums, and which is subject to significant erosion has been stabilized by the placement of a cover of large – up to 4 foot diameter - bolder rip-rap. Additional boulder placement is proposed.
- Earthwork. Fill will be imported and placed, and grading conducted to reduce the slope.
- Loam & Seeding. Placement of a 4-inch thickness of loam, and seeding with a perennial seed mix.
- Erosion Control Blankets. GroGreen GS Coir Erosion Control Blankets will be placed over the seeded areas and secured in place.

Proposed Restoration Activities – Lower Section

- Pavement removal. 350 sf of driveway pavement has been permanently removed.
- Lawn Establishment. A total of approximately 900 sf of imported sod has been placed on either side of the existing duplex.
- Loam and Seeding. All exposed soil will be loamed and seeded as soon practical.

Stormwater Management (BMP)

A stormwater collection and conveyance system will be installed at the base of the Upper Section. The system is intended to capture and infiltrate runoff. The collection system will consist of two catch basins (CB1 south & CB2 north) and a 4-foot deep by 3-foot wide stone-filled trench having a 1.5-foot deep swale top. A length of 4-inch diameter perforated PVC pipe will extend along the bottom of the trench from CB1 to CB2. A drain line extending from the CB2 down to a manhole in Millbury Street will convey excess water to the municipal sewerage.

Stormwater Standards Compliance

Standard 1: There is no discharge directly to a wetland or surface water. All runoff that is not infiltrated on-Site will be conveyed to, or collected by, the municipal sewerage in Millbury Street for conveyance to the POTW.

Peak Rate Attenuation: Runoff calculations are provided in the attached HydroCAD Report and on Table 1 summarizing peak runoff rates (Qpeak) and total runoff volumes for the 2-, 10, 25, & 100-Year Design Storms.

- Precipitation data for the Design Storms for Worcester County were input from the HydroCAD Lookup Table: 2-Year = 3.13", 10-Year = 4.68", 25-Year = 5.88", 100-Year = 8.34".
- Soil on the Site is described as Canton Fine Sandy Loam (Unit 421), Hydrologic Soil Group B. One test pit was excavated at the location of CB2 and soil is described as Silt Loam. However, because bedrock outcropping is present, soils are likely to be shallow to bedrock, Site soil observations indicate a Silt Loam soil, and presence of boulder rip-rap, HSG C was used in the modeling to be conservative.
- Stormwater modeling was completed for three scenarios:
 1. Original Conditions - Prior to the earth removal conducted in 2021.
 2. Current Conditions in 2021 – for the existing altered Site after earth excavation.
 3. Proposed conditions – after proposed Site restoration.
 Model results are summarized in Table 1.
- Qpeak and runoff volumes under Proposed Conditions were less than those for the Current 2021 Conditions.

Standard 3: Recharge volumes were not calculated as the proposed work is for Site restoration and stabilization. New impervious surfaces are not proposed. However, the soil infiltration rate used in designing the Recharging Pipe system – Rawls Rate 2.41 inches/hour - is based on Site-specific soil observation.

Standard 4: Applicable items in this Standard are addressed in the attached Operations & Maintenance Plan. New development is not proposed and stormwater is not discharged directly – i.e. outfall or overland flow discharge - to a surface water or wetland. The two existing residences are connected to the municipal sewerage. Property management – e.g. solid waste, pet waste, driveway (2,145± sf) sand & salt, lawn & garden products – if present are in small amounts typical for residential properties. Large fuel spills are possible only from a heating oil delivery truck and such would be managed by the driver and delivery company.

Standard 5: Not applicable.

Standard 6: Not applicable.

Standard 7: The project is considered to be Re-Development as the Site has been altered. New development is not proposed; only Site restoration and stabilization.


Standard 8: Provided in the Operations & Maintenance Plan.

Standard 9: Attached.

Standard 10: Illicit discharges are unlikely due to the locations of the BMP features that provide limited access.

Alton Day Stone, PE, ASE

September 24, 2021



Alton D. Stone
09-24-21

TABLE 1: ORIGINAL, EXISTING & PROPOSED CONDITIONS - PEAK RUNOFF RATES & TOTAL RUNOFF VOLUMES
1089 Millbury Street - Worcester, Massachusetts

<u>WATERSHED Q_{peak}</u>	<u>DESIGN STORM</u>			
	2 yr cfs / af	10 yr cfs / af	25 yr cfs / af	100 yr cfs / af
Peak Runoff Rate [cfs] / Total Runoff Volume [af]				
Original Conditions (pre 2018)	0.63 / 0.051	1.48 / 0.116	2.21 / 0.174	3.79 / 0.304
Current Conditions (2021)	1.53 / 0.129	2.53 / 0.219	3.30 / 0.290	4.87 / 0.436
Proposed Conditions				
WSP-A To Interceptor Swale & Municipal Sewerage	0.08 / 0.009	0.81 / 0.039	1.20 / 0.065	2.02 / 0.123
WSP-B Direct to Millbury Street	0.70 / 0.044	1.36 / 0.087	1.89 / 0.123	3.00 / 0.201

cfs = cubic feet per second / af = acre-feet 1 acre-foot = 43,560 cubic feet

Under Proposed (Post-Development) Conditions Peak Stormwater Runoff Rates and Total Runoff Volumes will be less than those under the Current Conditions.

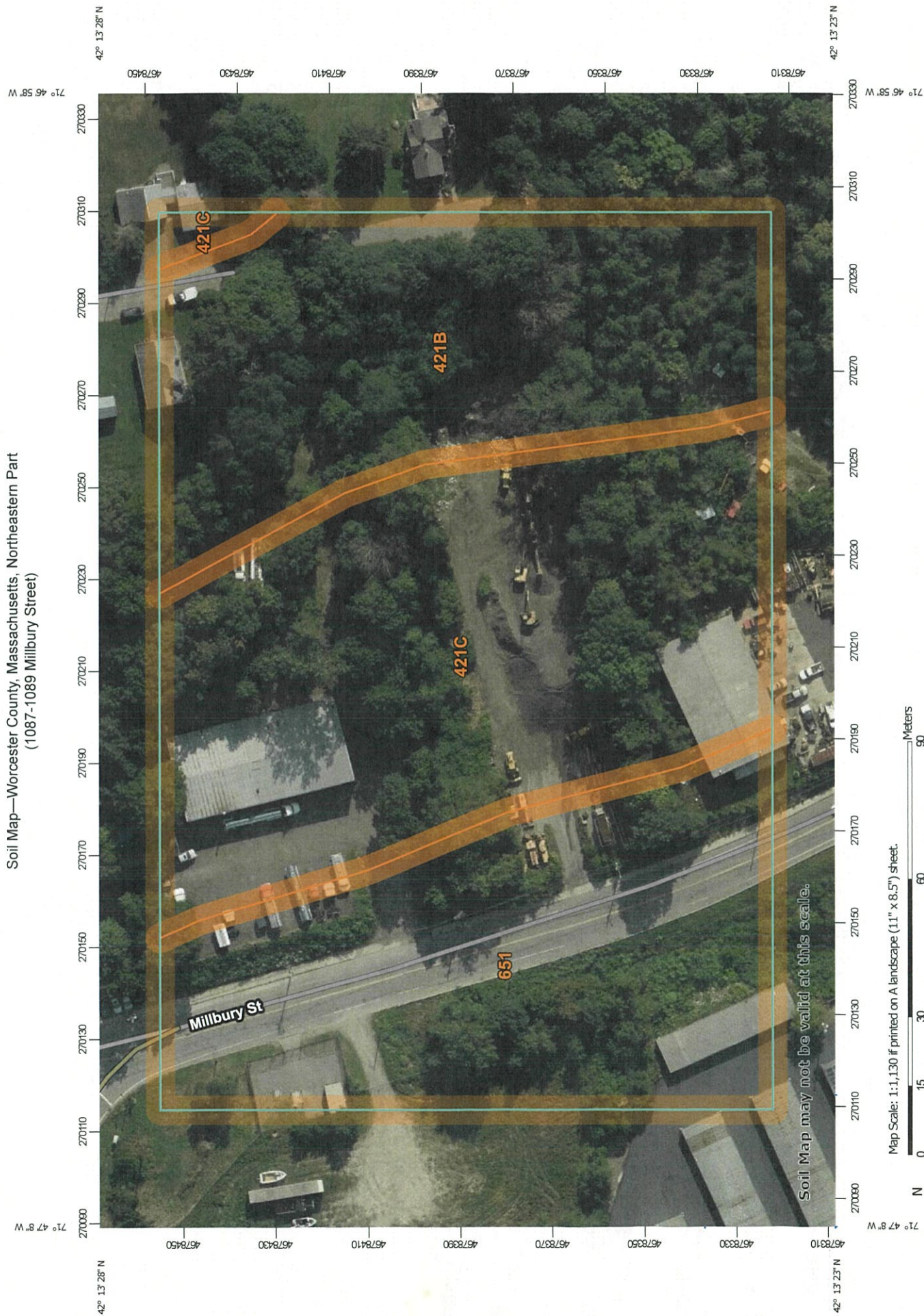
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Soil Map—Worcester County, Massachusetts, Northeastern Part (1087-1089 Millbury Street)







Soil Map may not be valid at this scale.

Map Scale: 1:1,130 if printed on A landscape (11" x 8.5") sheet.



Map projection: Web Mercator Corner coordinates: WGS84 Edge ticks: UTM Zone 19N WGS84

MAP LEGEND

	Area of Interest (AOI)		Spoil Area
	Area of Interest (AOI)		Stony Spot
	Soils		Very Stony Spot
	Soil Map Unit Polygons		Wet Spot
	Soil Map Unit Lines		Other
	Soil Map Unit Points		Special Line Features
	Special Point Features		Water Features
	Blowout		Streams and Canals
	Borrow Pit		Transportation
	Clay Spot		Rails
	Closed Depression		Interstate Highways
	Gravel Pit		US Routes
	Gravelly Spot		Major Roads
	Landfill		Local Roads
	Lava Flow		Background
	Marsh or swamp		Aerial Photography
	Mine or Quarry		
	Miscellaneous Water		
	Perennial Water		
	Rock Outcrop		
	Saline Spot		
	Sandy Spot		
	Severely Eroded Spot		
	Sinkhole		
	Slide or Slip		
	Sodic Spot		

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Worcester County, Massachusetts, Northeastern Part
Survey Area Data: Version 15, Jun 10, 2020

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Jul 26, 2019—Oct 5, 2019

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
421B	Canton fine sandy loam, 0 to 8 percent slopes, very stony	1.9	28.7%
421C	Canton fine sandy loam, 8 to 15 percent slopes, very stony	2.6	40.5%
651	Udorthents, smoothed	2.0	30.8%
Totals for Area of Interest		6.4	100.0%

Worcester County, Massachusetts, Northeastern Part

421B—Canton fine sandy loam, 0 to 8 percent slopes, very stony

Map Unit Setting

National map unit symbol: 2w81l

Elevation: 0 to 1,180 feet

Mean annual precipitation: 36 to 71 inches

Mean annual air temperature: 39 to 55 degrees F

Frost-free period: 140 to 240 days

Farmland classification: Farmland of statewide importance

Map Unit Composition

Canton, very stony, and similar soils: 80 percent

Minor components: 20 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Canton, Very Stony

Setting

Landform: Hills, moraines, ridges

Landform position (two-dimensional): Summit, shoulder, backslope

Landform position (three-dimensional): Side slope, crest, nose slope

Down-slope shape: Linear, convex

Across-slope shape: Convex

Parent material: Coarse-loamy over sandy melt-out till derived from gneiss, granite, and/or schist

Typical profile

Oi - 0 to 2 inches: slightly decomposed plant material

A - 2 to 5 inches: fine sandy loam

Bw1 - 5 to 16 inches: fine sandy loam

Bw2 - 16 to 22 inches: gravelly fine sandy loam

2C - 22 to 67 inches: gravelly loamy sand

Properties and qualities

Slope: 0 to 8 percent

Surface area covered with cobbles, stones or boulders: 1.6 percent

Depth to restrictive feature: 19 to 39 inches to strongly contrasting textural stratification

Drainage class: Well drained

Runoff class: Low

Capacity of the most limiting layer to transmit water

(Ksat): Moderately low to high (0.14 to 14.17 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)

Available water supply, 0 to 60 inches: Low (about 3.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 6s

Hydrologic Soil Group: B

Ecological site: F144AY034CT - Well Drained Till Uplands

Hydric soil rating: No

Minor Components

Scituate, very stony

Percent of map unit: 9 percent

Landform: Drumlins, hills, ground moraines

Landform position (two-dimensional): Footslope, backslope, summit

Landform position (three-dimensional): Side slope, crest

Down-slope shape: Linear, convex

Across-slope shape: Convex

Hydric soil rating: No

Montauk, very stony

Percent of map unit: 5 percent

Landform: Recessional moraines, drumlins, hills, ground moraines

Landform position (two-dimensional): Backslope, shoulder, summit

Landform position (three-dimensional): Side slope, crest

Down-slope shape: Linear, convex

Across-slope shape: Convex

Hydric soil rating: No

Gloucester, very stony

Percent of map unit: 4 percent

Landform: Hills, moraines, ridges

Landform position (two-dimensional): Backslope, shoulder, summit

Landform position (three-dimensional): Side slope, crest

Down-slope shape: Linear, convex

Across-slope shape: Convex

Hydric soil rating: No

Swansea

Percent of map unit: 2 percent

Landform: Kettles, swamps, bogs, marshes, depressions

Down-slope shape: Concave

Across-slope shape: Concave

Hydric soil rating: Yes

Data Source Information

Soil Survey Area: Worcester County, Massachusetts, Northeastern Part

Survey Area Data: Version 15, Jun 10, 2020

ALTON ENGINEERING

Hydrology - Water Resources – Environmental - Site Design & Permitting - Wetland Sciences

Alton Day Stone, PE, ASE

Registered Professional Engineer, Approved Soil Evaluator, Wetland Scientist

10 Rugg Road, Sterling, MA 01564

Office: 978.660.7728 | Email: altonengineering@gmail.com

OPERATION & MAINTENANCE PLAN

[Attachment to Stormwater Check List]

1087 - 1089 MILLBURY STREET, WORCESTER, MASSACHUSETTS

September 24, 2021

- *CONSTRUCTION PERIOD POLLUTION PREVENTION AND EROSION & SEDIMENT CONTROL PLAN**
- *LONG TERM POLLUTION PREVENTION PLAN**
- *STORMWATER DRAINAGE SYSTEM – OPERATIONS & MAINTENANCE PLAN**
- *ADDITIONAL INFORMATION.**

**Prepared By
Alton Engineering**

**Prepared For
Gold Star Builders
6 Jacques Street - Worcester, Massachusetts**

STANDARD 8 - CONSTRUCTION PERIOD POLLUTION PREVENTION AND EROSION & SEDIMENT CONTROL PLAN

This Plan describes procedures for control of erosion and sediment transport to be employed during the construction period for the 1087-1089 Property (the Site). For design and descriptive purposes the Site has been divided into Upper and Lower Sections.

- Upper Section – the area upslope of the Recharging Pipe (stormwater collection) that was altered by earth removal in 2021. This Section is steeply sloped – e.g. 2:1+ - westward towards Millbury Street. The majority of earthwork, slope stabilization and stormwater runoff control will be conducted in this area.
- Lower Section – the downslope remainder of the Site bordering on Millbury Street that has been developed; two residential duplexes (total impervious = 1,824 sf) and paved driveways (total impervious = 2,145± sf). This section of the Site also slopes westward to Millbury

Street, however the slope is moderate – 3:1± and the Section is stable. Limited restoration – loam & seeding) will be conducted on this Section.

- Re-Development features are shown on the enclosed Proposed Lawn Drainage Plan 1987-1089 Millbury Street Worcester, Massachusetts (the Plan) prepared by D. J. & Associates (Clinton, MA) dated September 21, 2021.

Operator & Responsible Party: Gold Star Builders

Mailing Address: 6 Jacques Street Worcester, MA.

Facility location: 1087-1089 Millbury Street Worcester, MA.

Phone Number: (Mr. Tony G. Nguyen) 508-736-7944.

Erosion Control Activities – Upper Section:

1. Erosion Control Line. An Erosion Control line consisting of silt fencing and 12-inch diameter straw wattles will be staked in place downslope of the Limit of Grading as shown on the Plan.
2. Rip-Rap. Boulder rip-rap has been placed on a portion of this Section to provide slope stabilization. Additional boulder rip-rap may be placed on the Upper Section, extending upslope from the lower Limit of Finish Grading.
3. Loam & Seed. Upon completion of Upper Section finished grading a 4-inch layer of loam will be placed over the exposed earth and then seeded with a perennial species seed mix.
4. Erosion Control Blankets. At completion of seeding the restored area will be covered with GroGreen GS Coir Erosion Control Blankets secured in place.
5. Rock Stabilized Construction Entrance . Vehicles and equipment access the Site via the existing paved remnant of Leland Street. The RSCE will be installed on this access midway up the Lower Section.
6. Recharging Pipe System. This system is an interceptor trench and swale for the collection and infiltration of runoff. The collection system will consist of two catch basins (CB1 south & CB2 north) and a 4-foot deep by 3-foot wide stone-filled trench having a 1.5-foot deep swale top. A length of 4-inch diameter perforated PVC pipe will extend along the bottom of the trench from CB1 to CB2. A drain line extending from the CB2 down to a catch basin (CB3) in Millbury Street will convey excess water to the municipal sewerage.
7. Sediment Filtration. Silt Sacs will be installed in Catch basins CB1, CB2 & CB3.

Erosion Control Activities – Lower Section:

1. Two stone check dams are in place on the Lower Section.
2. Exposed earth will surfaced with 4"± of loam and then seeded with a grass mix.

Construction Sequencing:

1. Installation of the erosion control line, stabilized construction entrance and Silt Sacs.
2. Importation of fill material to replace excavated material and reduce the slope grade.
3. Placement of additional boulder (1' to 4' diameter) rip-rap on that portion of the Upper Section that will not be graded.
4. Finish grading of the Upper Section.

5. Loaming and seeding on the Upper Section
6. Placement of erosion control blankets.
7. Construction of the Recharging Pipe stormwater collection and infiltration system at the base of the Upper Section; two catch basins, stone filled trench beneath a surface swale, and perforated piping to promote infiltration and provide conveyance of excess water to the second catch basin. This task is not to be initiated until the Upper Section slopes have been stabilized.
8. Installation of the drainage line from CB2 to CB3 in Millbury Street.
9. Loaming and seeding of the Lower Section.

- Removal of the ECL shall not occur until after final system inspection.
- Work shall not be conducted during periods of rainfall, excepting mist & drizzle.

Construction Period Inspection & Maintenance – Tasks & Schedule:

Storm Event:

In addition to the scheduled inspections, full inspections shall be conducted after each significant rain storm – i.e. 10-year storm or cloud burst in which 2+ inches of rain falls within a 15 to 30 minute interval.

Daily:

1. A Site Inspection shall be completed on a daily basis for evidence of erosion, and maintenance work conducted when observed.
2. The ECL shall be inspected daily for sediment buildup and line integrity. Accumulations of sediment greater than 6 -inches deep shall be removed.
3. The stabilized construction entrance shall be inspected for condition and earth build up and maintained as needed.
4. Inspection of Millbury Street in the vicinity of the Site for silt or ice accumulation (see Public Safety features, below).
5. Spillage or other action resulting in deposition of earth or related materials in Millbury Street shall be immediately cleaned up.
6. Street sweeping either by hand or mechanical means shall be conducted at the close of work along the Millbury Street Site entrance.

Weekly:

1. Silt sacs shall be installed in the two catch basins.
2. Inspection of the catch basins for sediment accumulation in the Silt Sacs. Sacs shall be changed out as needed.
3. At the time of Silt Sac change-out the basins shall be inspected for general condition and sediment deposition in the basin.
4. Sediment shall be removed when needed – i.e. when the sediment accumulation is one-half the height from the base to the invert of the outlet pipe.

Location and Design of BMP: Provided on the referenced plan

Public Safety Features:

1. Significant runoff or silt transport to Millbury Street that can produce a safety hazard. Siltation shall be removed as soon as feasible.
2. Ice formation on Millbury Street. If removal is not possible the affected area shall immediately be salted and sanded.
3. Corrective measures - e.g. additional erosion and runoff control - shall be implemented as soon as feasible.

Operations & Maintenance Log Form:***BMP Inspection Log – 087-1089 Millbury Street - Worcester, MA***

DATE: TIME:

PERSON:

WEATHER:

PPT IN LAST 24 HOURS:

➤ Erosion Control Line:

Observations and ECL Status.

Corrective Action Required. YES NO

➤ General Site Condition:

Observations and Status.

Corrective Action Required. YES NO

➤ Stabilized Construction Entrance:

Observations and Status.

Corrective Action Required. YES NO

➤ Millbury Street:

Observations and Status.

Corrective Action Required. YES NO

➤ Recharging Pipe System:

Observations and Status.

Corrective Action Required. YES NO

STANDARD 9 – LONG TERM OPERATIONS AND MAINTENANCE PLAN

This Plan describes procedures for the long term O & M of the Site, in particular the stormwater Recharging Pipe System and associated conveyance structures and piping.

Operator & Responsible Party:

1. Currently - Gold Star Builders, Mr. Tony G. Nguyen (508-736-7944).
2. Future property owner(s).

General:

1. The current and future Site use is residential living. Two houses are currently on the Site. Surface waters, wetlands and critical areas, or other sensitive receptors are not situated in the vicinity of the Site.
2. The only BMP is the Recharging Pipe system. Upon stabilization of the Upper Section, Silt Sacs will no longer be necessary in the catch basins. The basins shall be inspected every two months and sediment removed as necessary.
3. Lawn and landscaping products – e.g. will be stored in the respective residence buildings.
4. Pet waste will be cleaned up as needed and disposed of as solid waste.
5. Solid waste – primarily light trash – will be managed according to City provisions.
6. Sand & road-salt will be stored in the buildings.
7. Illegal dumping to the catch basins is difficult to control; however, the locations of the two basins CB1 & CB2) in the Upper Section would make such use difficult. It is noted that the stormwater management system does not discharge directly to a surface water or wetland.
8. The only possible significant liquid spills are:
 - i. Residential parking – e.g. leaking or spilling of engine and motor vehicle fluids (possible and occasional).
 - ii. Spill from a home heating oil delivery truck (very unlikely and uncommon).

Spill Prevention and Response Plan:

1. As noted in ¶18 Leaking of automotive fluids is the most common residential spill. Small spills can be cleaned up by the homeowner. For larger spills that the home owners cannot manage – typically > than 5 gallons - the Department of Environmental Protection or Worcester Fire Department can be contacted for assistance.

- **Worcester Fire Department – 911.**
- **Department of Environmental Protection, Emergency Response – 888-304-1133.**

2. A delivery truck spill would be managed by the driver, oil supply company, and the company's emergency response contractor in addition to the Fire Department and DEP.

STANDARD 10 – PROHIBITION OF ILLICIT DISCHARGES

Illicit discharges – e.g. floor drains, industrial, sanitary or industrial waste water - are not present under current conditions and will not be under future conditions. The property is serviced by the Municipal sewerage. Therefore an illicit discharge is very unlikely.

ADDITIONAL INFORMATION

1. The project consists of restoration of a large area of excavation and renovating a developed Site for continued residential use.
2. LID Measures are not applicable.
3. Peak runoff rates have been attenuated as documented in the Drainage Report.
4. A Required Recharge Volume is not applicable and was not calculated. The proposed Recharging Pipe system will provide groundwater recharge.

1089

Current 2020
Conditions 1087-1089
Millbury St. TOTAL LOT

P-A

Proposed 2021
Conditions 1087-1089
Millbury St. Upper
Section to Drain
System

P-B

Proposed 2021
Conditions 1087-1089
Millbury St. Lower
Section To Millbury
Street

CB
CB1

Catch Basin 1

IT

Interceptor/Recharge
Trench

CB
CB2

Catch Basin

DL

12" D PVC Drail Line to
CB2 in Millbury Street &
Municipal Sewer

CB3

Design Point - Municipal
Catch Basin in Millbury
Street

MS

Design Point - Millbury
Street

C-M.S.

Design Point - Current
Conditions - Millbury
Street



Alton Stone
09-23-21



Routing Diagram for %%REV FULL PROPOSED_ 2021 -1089 Millbury Steet 09-22-21
Prepared by Alton Engineering, Printed 9/23/2021
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TABLE 1: ORIGINAL, EXISTING & PROPOSED CONDITIONS - PEAK RUNOFF RATES & TOTAL RUNOFF VOLUMES
1089 Millbury Street - Worcester, Massachusetts

<u>WATERSHED Q_{peak}</u>		<u>DESIGN STORM</u>			
Peak Runoff Rate [cfs] / Total Runoff Volume [af]		2 yr <u>cfs / af</u>	10 yr <u>cfs / af</u>	25 yr <u>cfs / af</u>	100 yr <u>cfs / af</u>
Original Conditions (pre 2018)		0.63 / 0.051	1.48 / 0.116	2.21 / 0.174	3.79 / 0.304
Current Conditions (2021)		1.53 / 0.129	2.53 / 0.219	3.30 / 0.290	4.87 / 0.436
Proposed Conditions					
WSP-A To Interceptor Swale & Municipal Sewerage		0.08 / 0.009	0.81 / 0.039	1.20 / 0.065	2.02 / 0.123
WSP-B Direct to Millbury Street		0.70 / 0.044	1.36 / 0.087	1.89 / 0.123	3.00 / 0.201

cfs = cubic feet per second / af = acre-feet 1 acre-foot = 43,560 cubic feet

Under Proposed (Post-Development) Conditions Peak Stormwater Runoff Rates and Total Runoff Volumes will be less than those under the Current Conditions.

ALTON ENGINEERING
10 RUGG ROAD - STERLING, MA 01564
978.660.7728
ALTONENGINEERING@GMAIL.COM

Rainfall Events Listing (selected events)

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2-Year	NRCC 24-hr	D	Default	24.00	1	3.13	2
2	10-Year	NRCC 24-hr	D	Default	24.00	1	4.68	2
3	25-Year	NRCC 24-hr	D	Default	24.00	1	5.88	2
4	100-Year	NRCC 24-hr	D	Default	24.00	1	8.34	2

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.601	74	>75% Grass cover, Good, HSG C (1089, P-A, P-B)
0.142	83	Boulders (1089, P-A, P-B)
0.605	91	Fallow, bare soil, HSG C (1089)
0.084	98	House Roofs (1089, P-B)
0.098	98	Pavement (1089, P-B)
0.088	70	Woods, Good, HSG C (1089, P-A)
1.617	84	TOTAL AREA

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
1.293	HSG C	1089, P-A, P-B
0.000	HSG D	
0.324	Other	1089, P-A, P-B
1.617		TOTAL AREA

%%REV FULL PROPOSED_ 2021 -1089 Millbury Steet 09-22-21

Prepared by Alton Engineering

Printed 9/23/2021

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Page 5

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.000	0.601	0.000	0.000	0.601	>75% Grass cover, Good	1089, P-A, P-B
0.000	0.000	0.000	0.000	0.142	0.142	Boulders	1089, P-A, P-B
0.000	0.000	0.605	0.000	0.000	0.605	Fallow, bare soil	1089
0.000	0.000	0.000	0.000	0.084	0.084	House Roofs	1089, P-B
0.000	0.000	0.000	0.000	0.098	0.098	Pavement	1089, P-B
0.000	0.000	0.088	0.000	0.000	0.088	Woods, Good	1089, P-A
0.000	0.000	1.293	0.000	0.324	1.617	TOTAL AREA	

Pipe Listing (all nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Width (inches)	Diam/Height (inches)	Inside-Fill (inches)
1	DL	444.70	442.20	151.0	0.0166	0.010	0.0	12.0	0.0
2	CB1	445.50	445.40	5.0	0.0200	0.010	0.0	12.0	0.0
3	CB2	447.70	442.80	171.0	0.0287	0.010	0.0	12.0	0.0
4	IT	446.50	446.40	5.0	0.0200	0.010	0.0	12.0	0.0

Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
 Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
 Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1089: Current 2020	Runoff Area=35,229 sf 11.27% Impervious Runoff Depth>1.91" Flow Length=259' Tc=10.5 min CN=90 Runoff=1.53 cfs 0.129 af
Subcatchment P-A: Poposed 2021	Runoff Area=15,871 sf 0.00% Impervious Runoff Depth>0.91" Flow Length=117' Tc=4.3 min CN=75 Runoff=0.43 cfs 0.028 af
Subcatchment P-B: Poposed 2021	Runoff Area=19,358 sf 20.50% Impervious Runoff Depth>1.20" Flow Length=139' Tc=3.8 min CN=80 Runoff=0.70 cfs 0.044 af
Reach DL: 12" D PVC Drail Line to CB2	Avg. Flow Depth=0.08' Max Vel=2.72 fps Inflow=0.09 cfs 0.009 af 12.0" Round Pipe n=0.010 L=151.0' S=0.0166 ' /' Capacity=5.96 cfs Outflow=0.08 cfs 0.009 af
Pond CB1: Catch Basin 1	Peak Elev=445.84' Inflow=0.43 cfs 0.028 af 12.0" Round Culvert n=0.010 L=5.0' S=0.0200 ' /' Outflow=0.43 cfs 0.028 af
Pond CB2: Catch Basin	Peak Elev=447.84' Inflow=0.09 cfs 0.009 af 12.0" Round Culvert n=0.010 L=171.0' S=0.0287 ' /' Outflow=0.09 cfs 0.009 af
Pond IT: Interceptor?RechargeTrench	Peak Elev=446.66' Storage=398 cf Inflow=0.43 cfs 0.028 af Discarded=0.01 cfs 0.010 af Primary=0.09 cfs 0.009 af Outflow=0.10 cfs 0.019 af
Link C-M.S.: Design Point - Current Conditions - Millbury Street	Inflow=1.53 cfs 0.129 af Primary=1.53 cfs 0.129 af
Link CB3: Design Point - Municipal Catch Basin in Millbury Street	Inflow=0.08 cfs 0.009 af Primary=0.08 cfs 0.009 af
Link MS: Design Point - Millbury Street	Inflow=0.70 cfs 0.044 af Primary=0.70 cfs 0.044 af

Total Runoff Area = 1.617 ac Runoff Volume = 0.201 af Average Runoff Depth = 1.49"
88.73% Pervious = 1.435 ac 11.27% Impervious = 0.182 ac

Summary for Subcatchment 1089: Current 2020 Conditions 1087-1089 Millbury St.TOTAL LOT

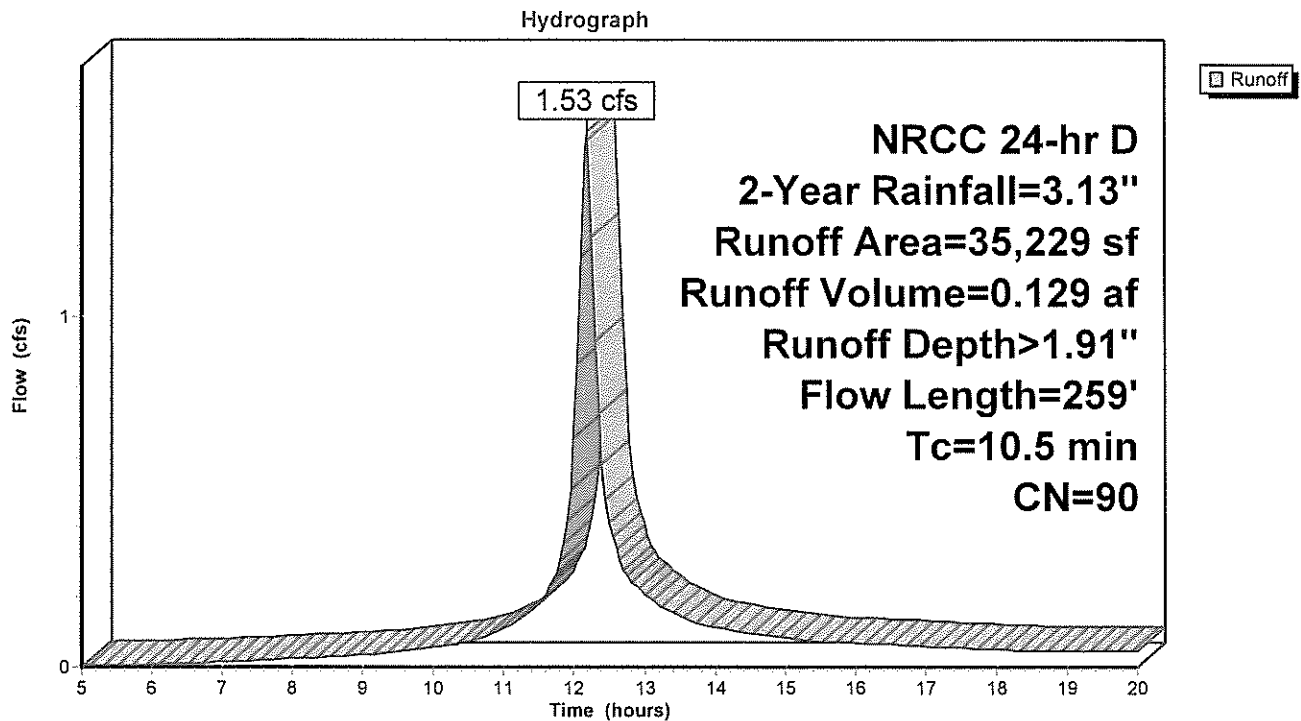
Runoff = 1.53 cfs @ 12.18 hrs, Volume= 0.129 af, Depth> 1.91"
 Routed to Link C-M.S. : Design Point - Current Conditions - Millbury Street

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 NRCC 24-hr D 2-Year Rainfall=3.13"

Area (sf)	CN	Description
1,900	70	Woods, Good, HSG C
820	74	>75% Grass cover, Good, HSG C
* 1,824	98	House Roofs
* 2,145	98	Pavement
* 2,200	83	Boulders
26,340	91	Fallow, bare soil, HSG C
35,229	90	Weighted Average
31,260		88.73% Pervious Area
3,969		11.27% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.8	32	0.0600	0.05		Sheet Flow, Sheet Flow
					Woods: Dense underbrush n= 0.800 P2= 3.13"
0.1	73	0.4500	10.80		Shallow Concentrated Flow, Shallow Concentrated
					Unpaved Kv= 16.1 fps
0.6	154	0.0840	4.67		Shallow Concentrated Flow, Shallo Concentrated
					Unpaved Kv= 16.1 fps
10.5	259	Total			

Subcatchment 1089: Current 2020 Conditions 1087-1089 Millbury St. TOTAL LOT



ary for Subcatchment P-A: Poposed 2021 Conditions 1087-1089 Millbury St. Upper Section to Dra

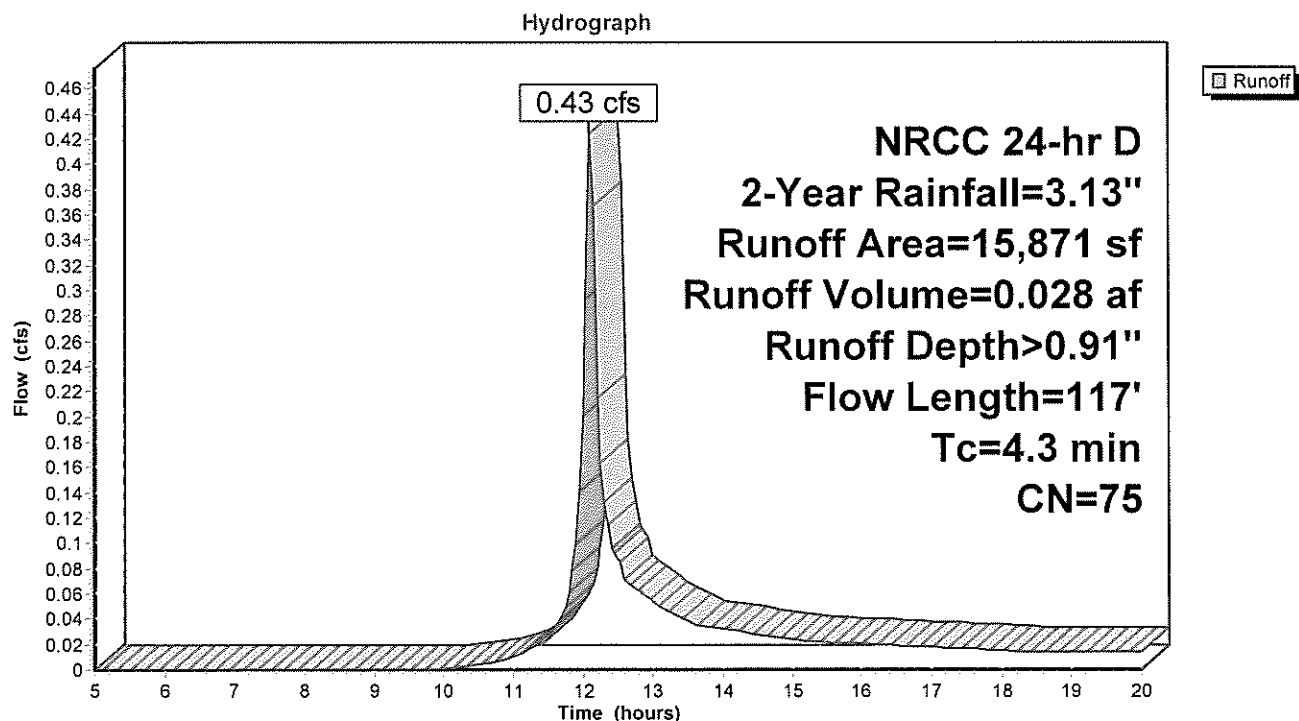
Runoff = 0.43 cfs @ 12.11 hrs, Volume= 0.028 af, Depth> 0.91"
 Routed to Pond CB1 : Catch Basin 1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 NRCC 24-hr D 2-Year Rainfall=3.13"

Area (sf)	CN	Description
1,913	70	Woods, Good, HSG C
11,343	74	>75% Grass cover, Good, HSG C
* 2,615	83	Boulders
15,871	75	Weighted Average
15,871		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.4	10	0.2000	0.07		Sheet Flow, Sheet Flow-1 Trees Woods: Dense underbrush n= 0.800 P2= 3.13"
1.6	40	0.3000	0.41		Sheet Flow, Sheet Flow 2 - Grass Grass: Short n= 0.150 P2= 3.13"
0.3	67	0.3000	3.83		Shallow Concentrated Flow, Shallow Concentrated Short Grass Pasture Kv= 7.0 fps
4.3	117	Total			

Subcatchment P-A: Poposed 2021 Conditions 1087-1089 Millbury St. Upper Section to Drain Syst



ry for Subcatchment P-B: Poposed 2021 Conditions 1087-1089 Millbury St. Lower Section To Mill

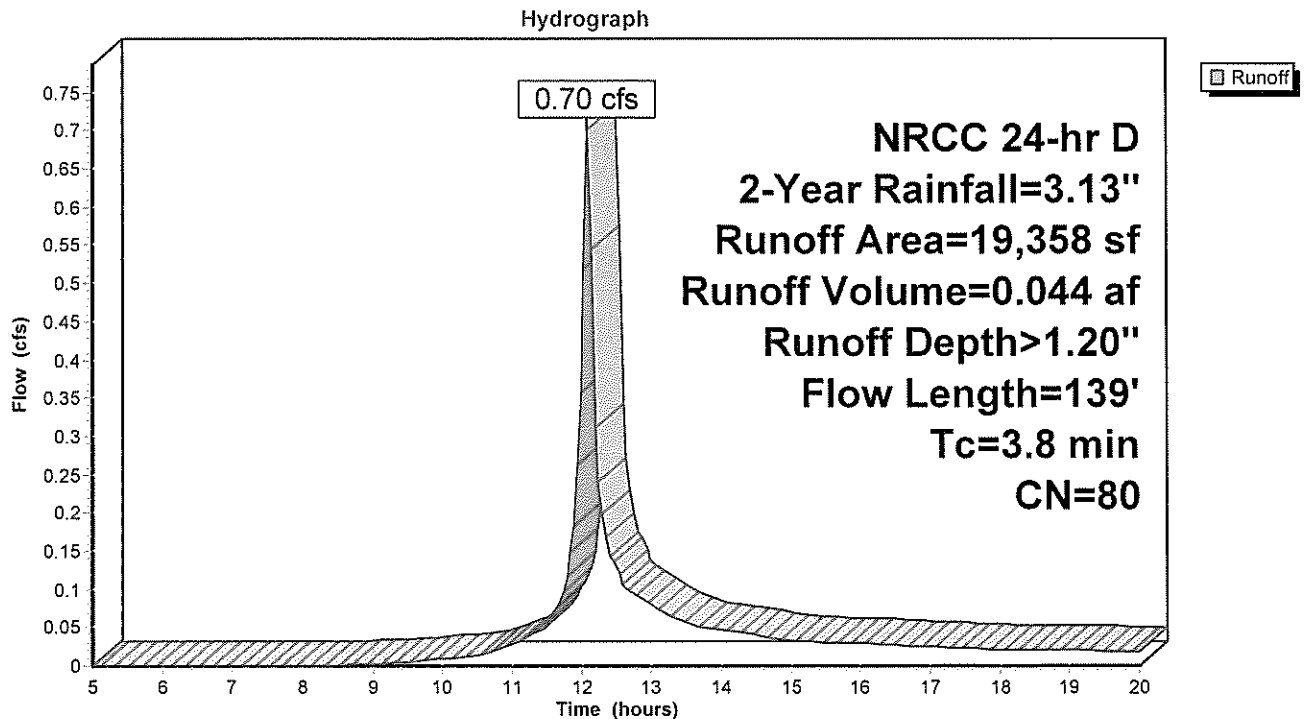
Runoff = 0.70 cfs @ 12.10 hrs, Volume= 0.044 af, Depth> 1.20"
 Routed to Link MS : Design Point - Millbury Street

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 NRCC 24-hr D 2-Year Rainfall=3.13"

Area (sf)	CN	Description
14,010	74	>75% Grass cover, Good, HSG C
* 1,824	98	House Roofs
* 2,145	98	Pavement
* 1,379	83	Boulders
19,358	80	Weighted Average
15,389		79.50% Pervious Area
3,969		20.50% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.0	50	0.1000	0.28		Sheet Flow, Sheet Flow - Grass
					Grass: Short n= 0.150 P2= 3.13"
0.8	89	0.0700	1.85		Shallow Concentrated Flow, Shallow Concentrated
					Short Grass Pasture Kv= 7.0 fps
3.8	139	Total			

Subcatchment P-B: Poposed 2021 Conditions 1087-1089 Millbury St. Lower Section To Millbury St



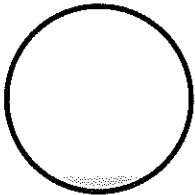
Summary for Reach DL: 12" D PVC Drail Line to CB2 in Millbury Street & Municipal Sewer

Inflow Area = 0.364 ac, 0.00% Impervious, Inflow Depth > 0.30" for 2-Year event
 Inflow = 0.09 cfs @ 12.41 hrs, Volume= 0.009 af
 Outflow = 0.08 cfs @ 12.45 hrs, Volume= 0.009 af, Atten= 2%, Lag= 2.3 min
 Routed to Link CB3 : Design Point - Municipal Catch Basin in Millbury Street

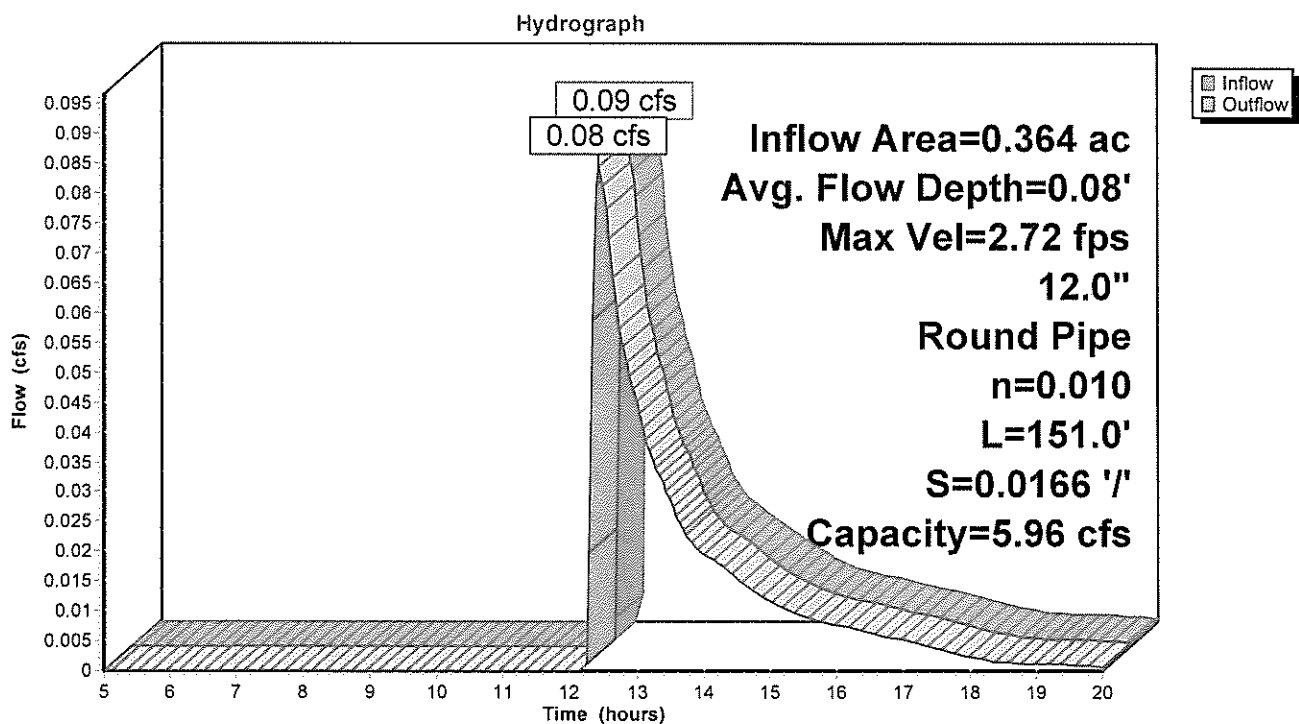
Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 Max. Velocity= 2.72 fps, Min. Travel Time= 0.9 min
 Avg. Velocity= 1.37 fps, Avg. Travel Time= 1.8 min

Peak Storage= 5 cf @ 12.42 hrs
 Average Depth at Peak Storage= 0.08' , Surface Width= 0.55'
 Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 5.96 cfs

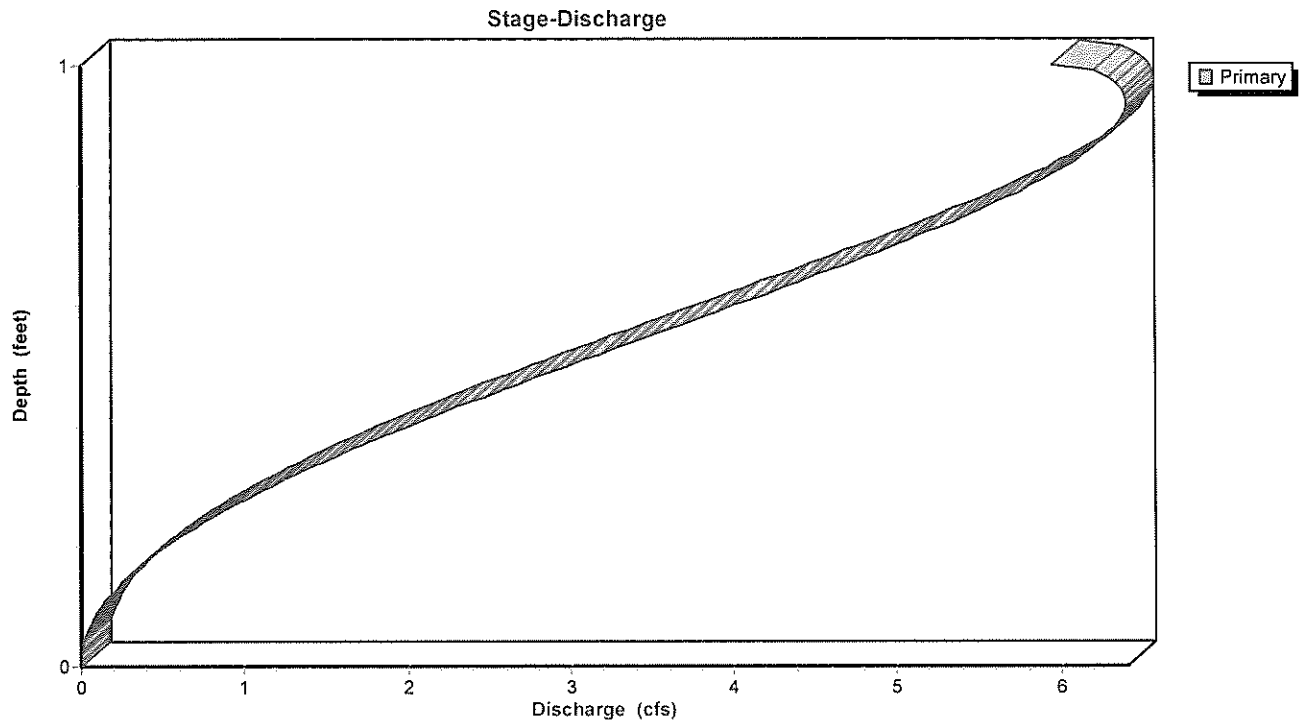
12.0" Round Pipe
 n= 0.010
 Length= 151.0' Slope= 0.0166 '/
 Inlet Invert= 444.70', Outlet Invert= 442.20'



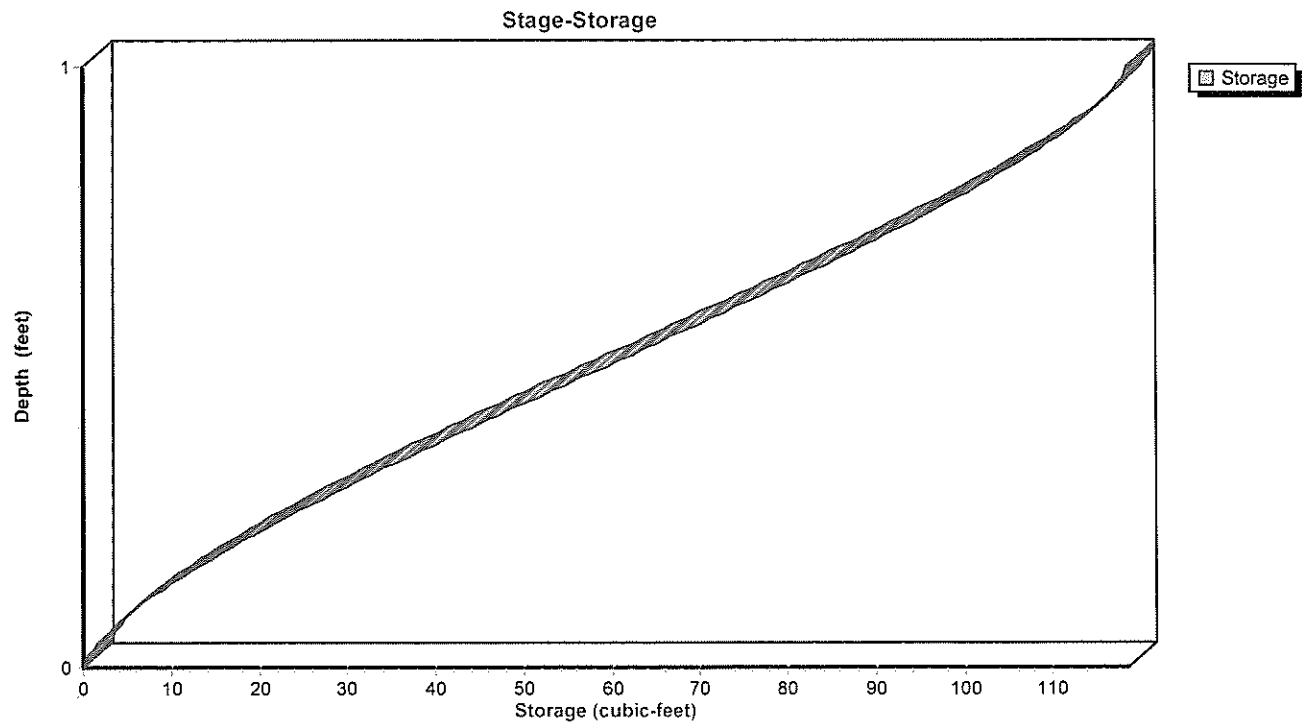
Reach DL: 12" D PVC Drail Line to CB2 in Millbury Street & Municipal Sewer



Reach DL: 12" D PVC Drail Line to CB2 in Millbury Street & Municipal Sewer



Reach DL: 12" D PVC Drail Line to CB2 in Millbury Street & Municipal Sewer



Summary for Pond CB1: Catch Basin 1

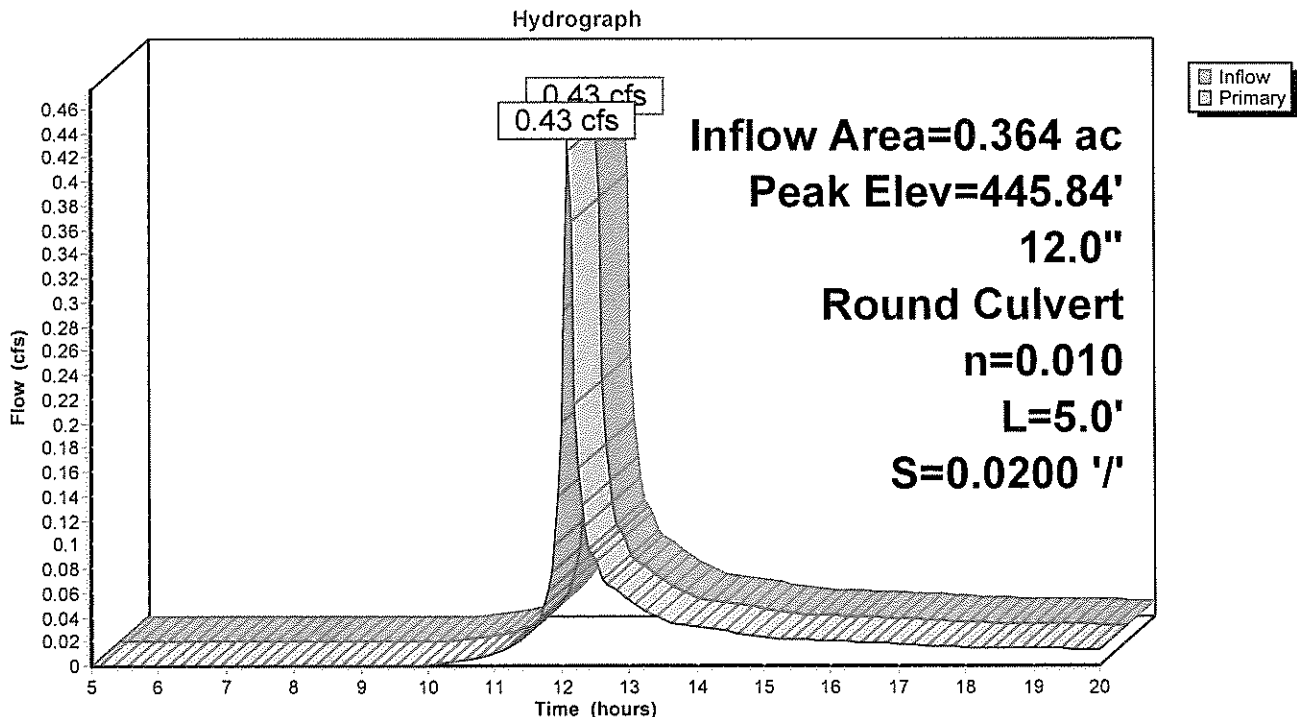
Inflow Area = 0.364 ac, 0.00% Impervious, Inflow Depth > 0.91" for 2-Year event
 Inflow = 0.43 cfs @ 12.11 hrs, Volume= 0.028 af
 Outflow = 0.43 cfs @ 12.11 hrs, Volume= 0.028 af, Atten= 0%, Lag= 0.0 min
 Primary = 0.43 cfs @ 12.11 hrs, Volume= 0.028 af
 Routed to Pond IT : Interceptor?Recharge Trench

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 Peak Elev= 445.84' @ 12.11 hrs

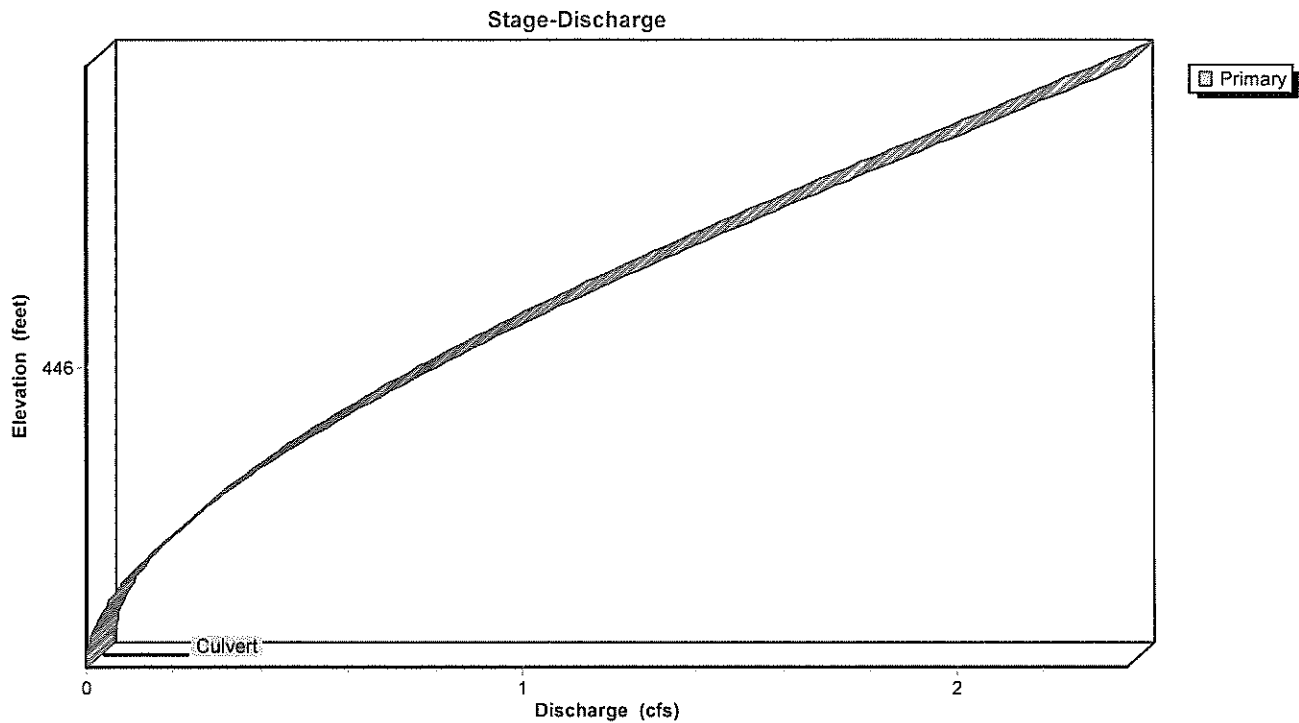
Device	Routing	Invert	Outlet Devices
#1	Primary	445.50'	12.0" Round Culvert L= 5.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 445.50' / 445.40' S= 0.0200 '/ Cc= 0.900 n= 0.010, Flow Area= 0.79 sf

Primary OutFlow Max=0.41 cfs @ 12.11 hrs HW=445.84' (Free Discharge)
 1=Culvert (Barrel Controls 0.41 cfs @ 2.65 fps)

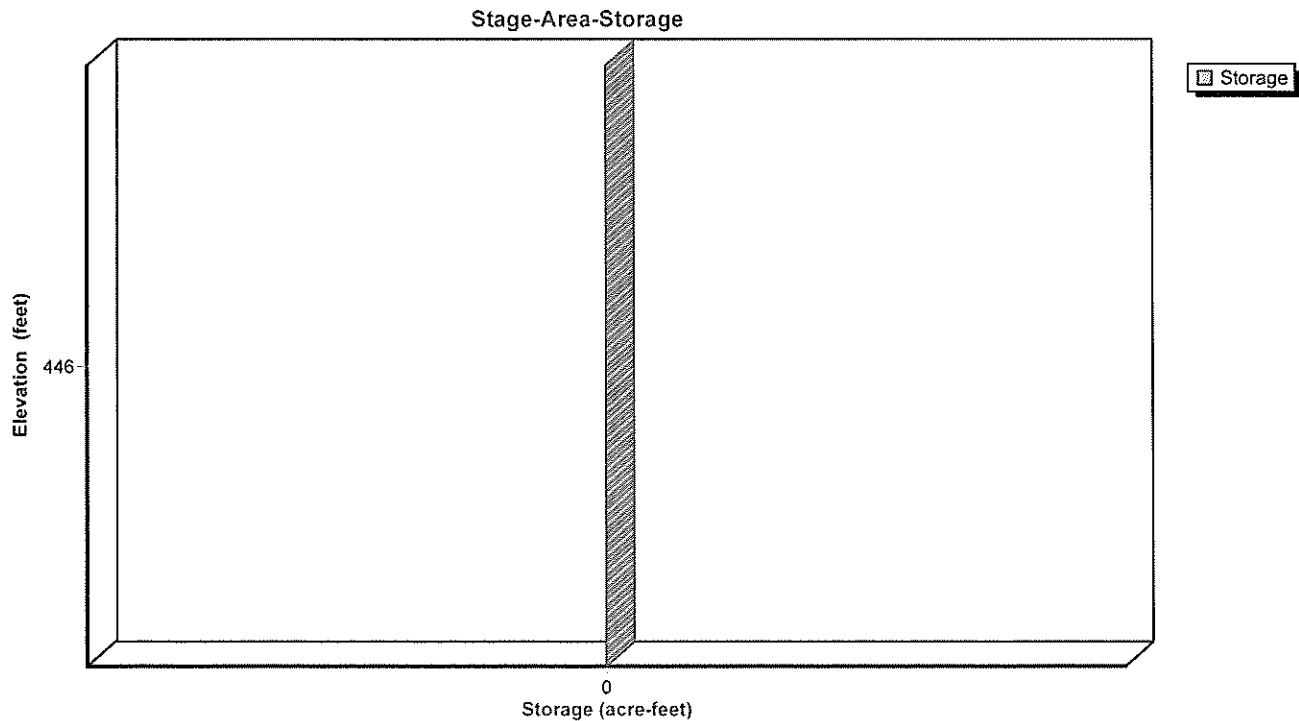
Pond CB1: Catch Basin 1



Pond CB1: Catch Basin 1



Pond CB1: Catch Basin 1



Summary for Pond CB2: Catch Basin

Inflow Area = 0.364 ac, 0.00% Impervious, Inflow Depth > 0.30" for 2-Year event
Inflow = 0.09 cfs @ 12.41 hrs, Volume= 0.009 af
Outflow = 0.09 cfs @ 12.41 hrs, Volume= 0.009 af, Atten= 0%, Lag= 0.0 min
Primary = 0.09 cfs @ 12.41 hrs, Volume= 0.009 af
Routed to Reach DL : 12" D PVC Drail Line to CB2 in Millbury Street & Municipal Sewer

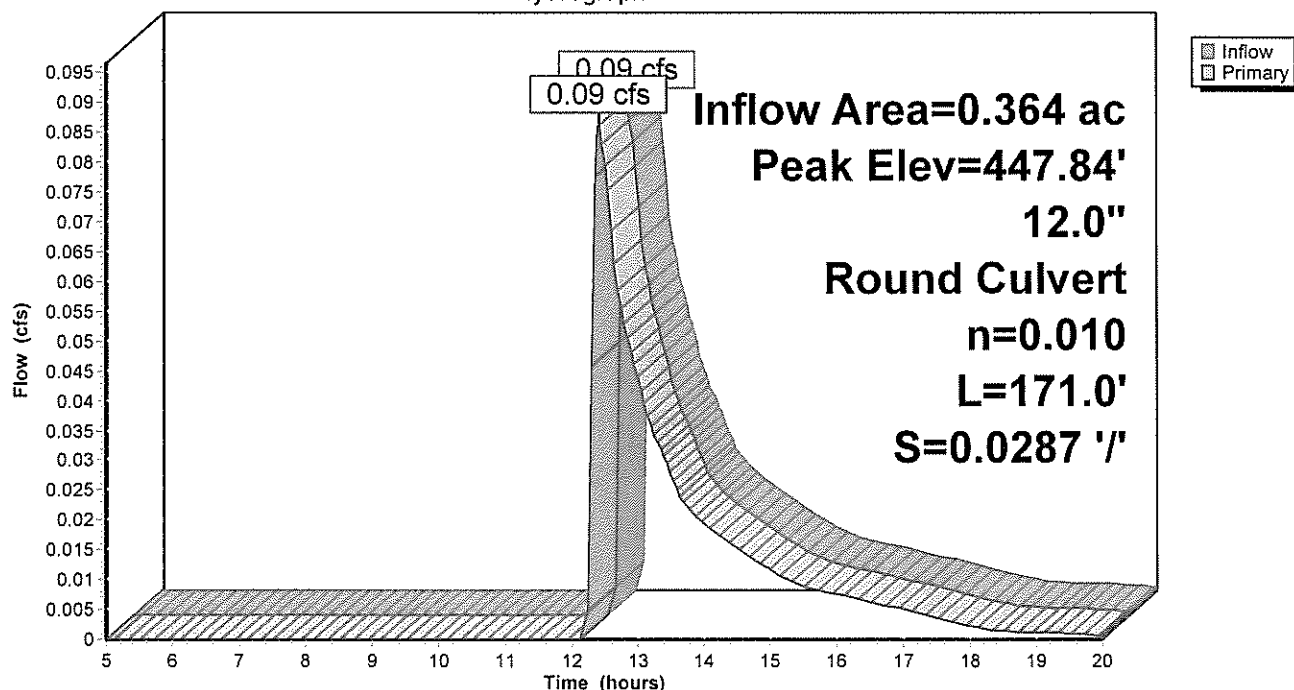
Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 447.84' @ 12.41 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	447.70'	12.0" Round Culvert L= 171.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 447.70' / 442.80' S= 0.0287 ' / Cc= 0.900 n= 0.010. Flow Area= 0.79 sf

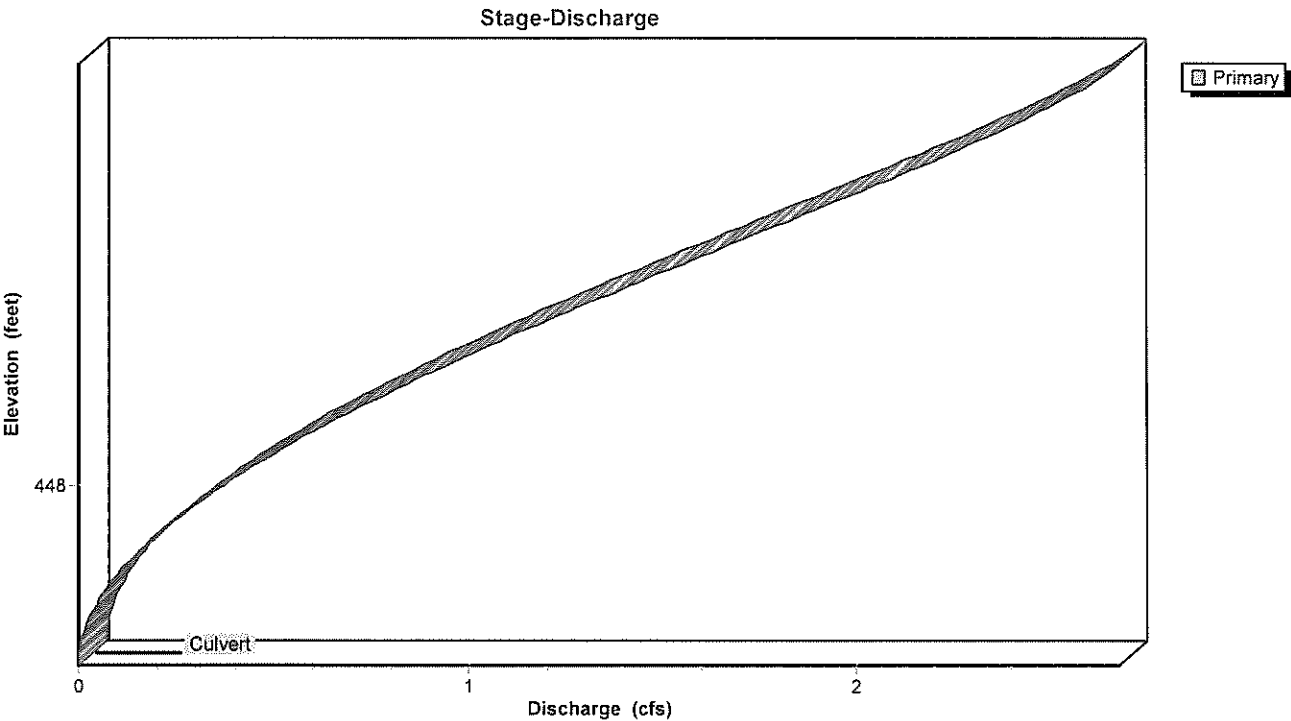
Primary OutFlow Max=0.09 cfs @ 12.41 hrs HW=447.84' (Free Discharge)
 1=Culvert (Inlet Controls 0.09 cfs @ 1.27 fps)

Pond CB2: Catch Basin

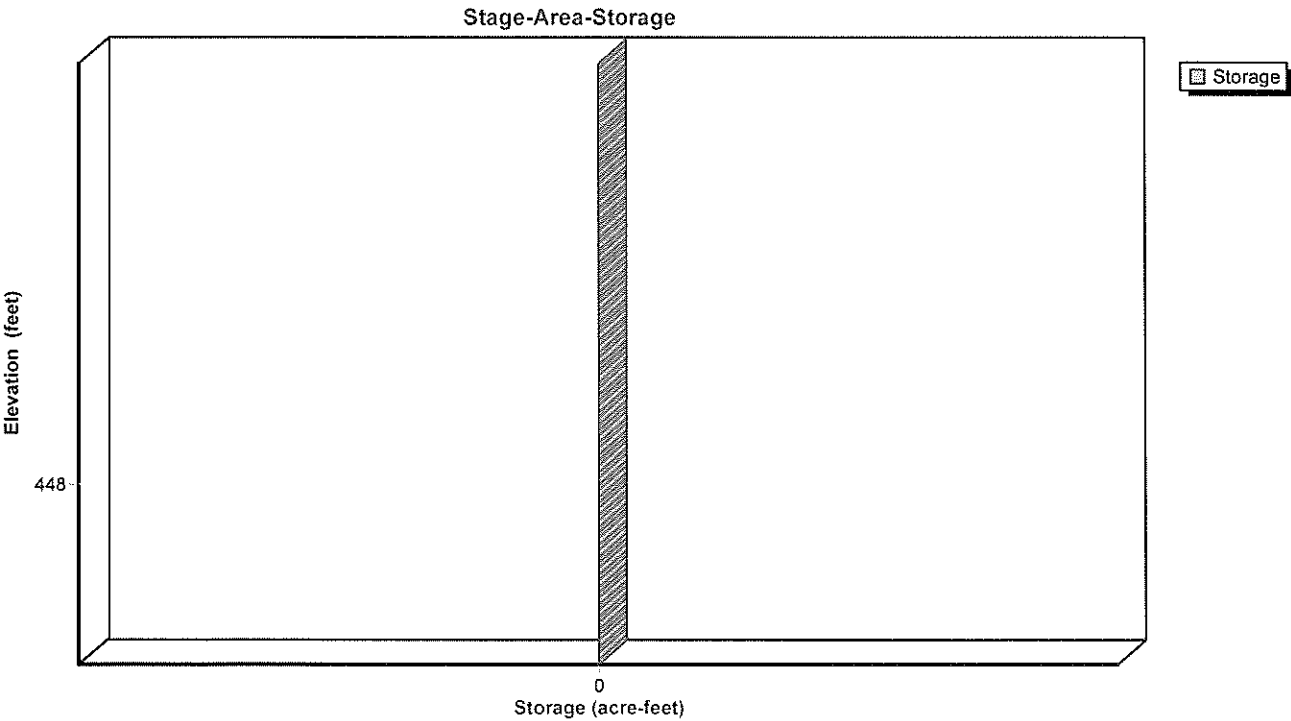
Hydrograph



Pond CB2: Catch Basin



Pond CB2: Catch Basin



Summary for Pond IT: Interceptor?Recharge Trench

Inflow Area = 0.364 ac, 0.00% Impervious, Inflow Depth > 0.91" for 2-Year event
 Inflow = 0.43 cfs @ 12.11 hrs, Volume= 0.028 af
 Outflow = 0.10 cfs @ 12.41 hrs, Volume= 0.019 af, Atten= 77%, Lag= 18.1 min
 Discarded = 0.01 cfs @ 11.35 hrs, Volume= 0.010 af
 Primary = 0.09 cfs @ 12.41 hrs, Volume= 0.009 af
 Routed to Pond CB2 : Catch Basin

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 Peak Elev= 446.66' @ 12.41 hrs Surf.Area= 240 sf Storage= 398 cf

Plug-Flow detention time= 131.3 min calculated for 0.019 af (70% of inflow)
 Center-of-Mass det. time= 51.9 min (880.0 - 828.1)

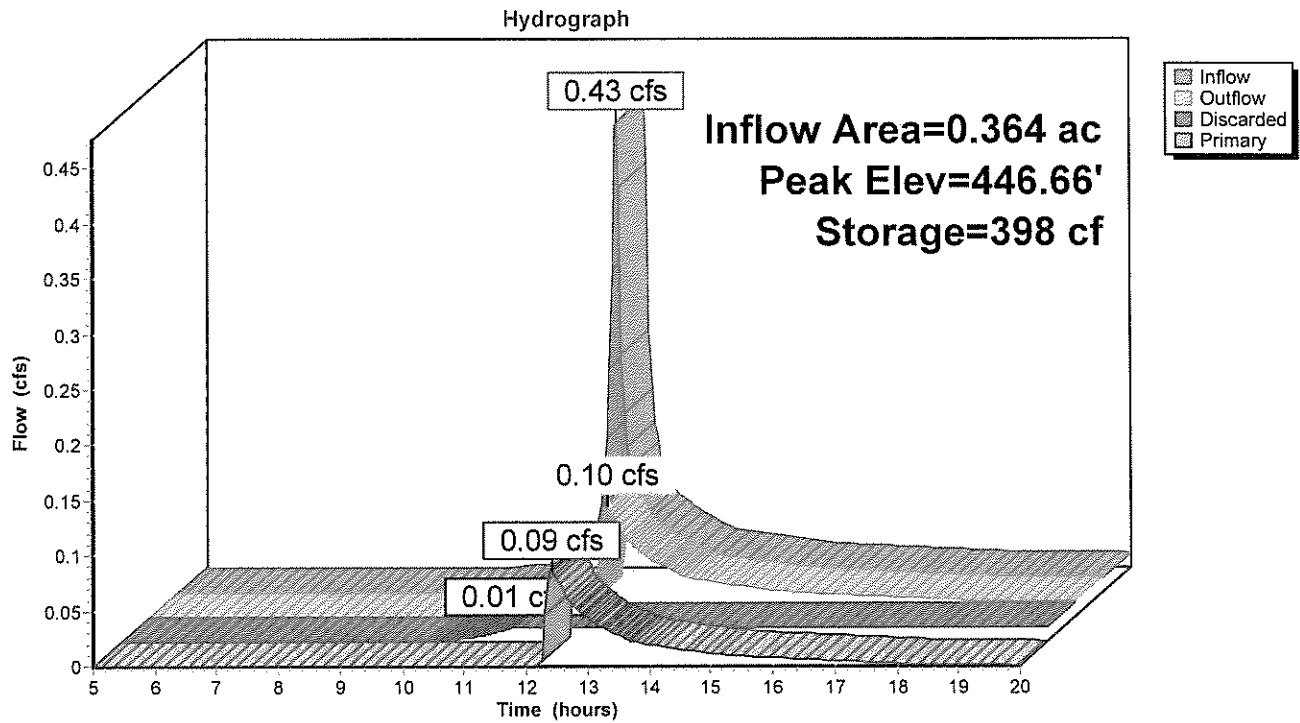
Volume	Invert	Avail.Storage	Storage Description
#1	445.00'	960 cf	3.00'W x 80.00'L x 4.00'H Prismatic

Device	Routing	Invert	Outlet Devices
#1	Discarded	445.00'	2.410 in/hr Exfiltration over Horizontal area
#2	Primary	446.50'	12.0" Round Culvert L= 5.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 446.50' / 446.40' S= 0.0200 ' / ' Cc= 0.900 n= 0.010, Flow Area= 0.79 sf

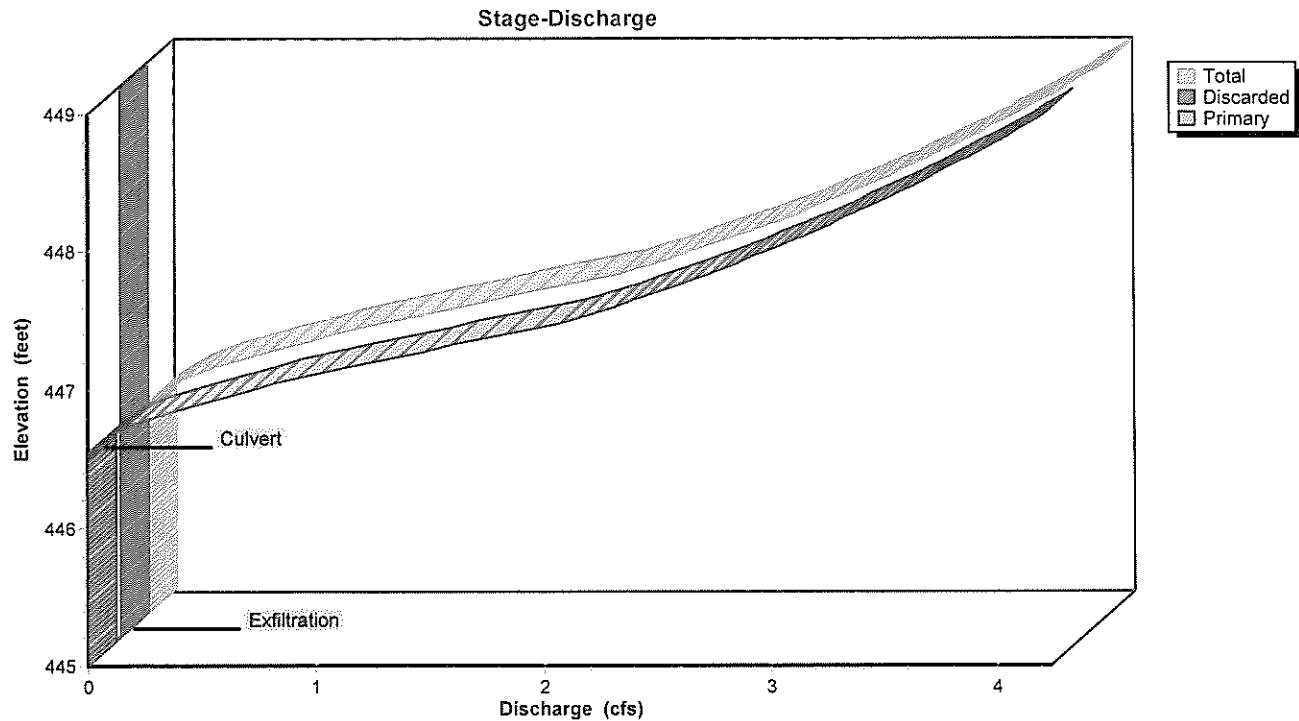
Discarded OutFlow Max=0.01 cfs @ 11.35 hrs HW=445.04' (Free Discharge)
 ↑1=Exfiltration (Exfiltration Controls 0.01 cfs)

Primary OutFlow Max=0.08 cfs @ 12.41 hrs HW=446.66' (Free Discharge)
 ↑2=Culvert (Inlet Controls 0.08 cfs @ 1.07 fps)

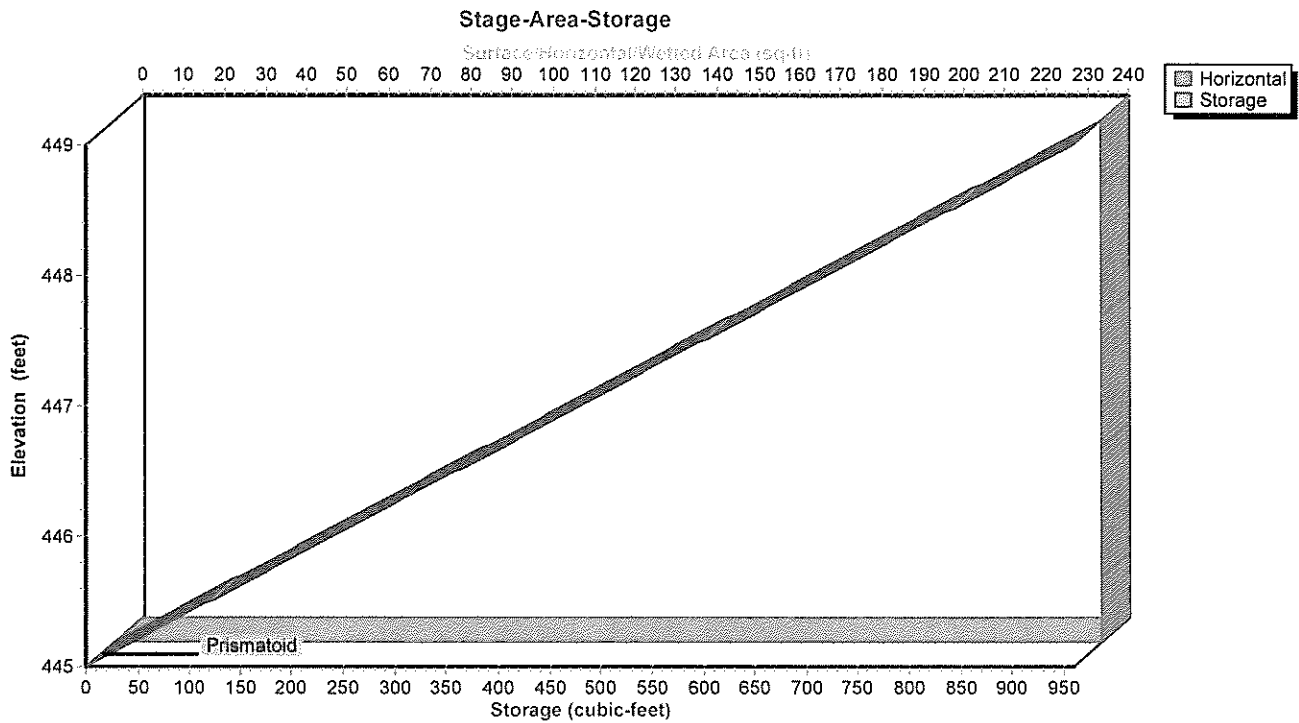
Pond IT: Interceptor?Recharge Trench



Pond IT: Interceptor?Recharge Trench



Pond IT: Interceptor?Recharge Trench

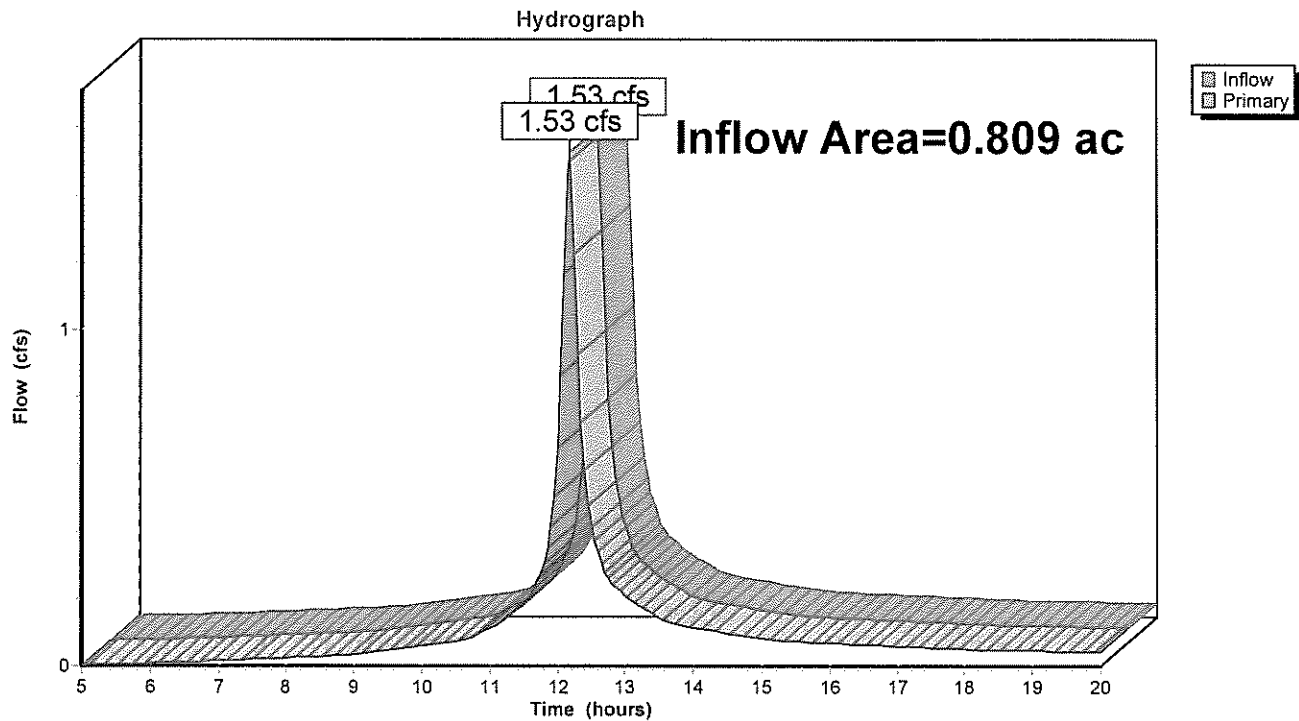


Summary for Link C-M.S.: Design Point - Current Conditions - Millbury Street

Inflow Area = 0.809 ac, 11.27% Impervious, Inflow Depth > 1.91" for 2-Year event
Inflow = 1.53 cfs @ 12.18 hrs, Volume= 0.129 af
Primary = 1.53 cfs @ 12.18 hrs, Volume= 0.129 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link C-M.S.: Design Point - Current Conditions - Millbury Street

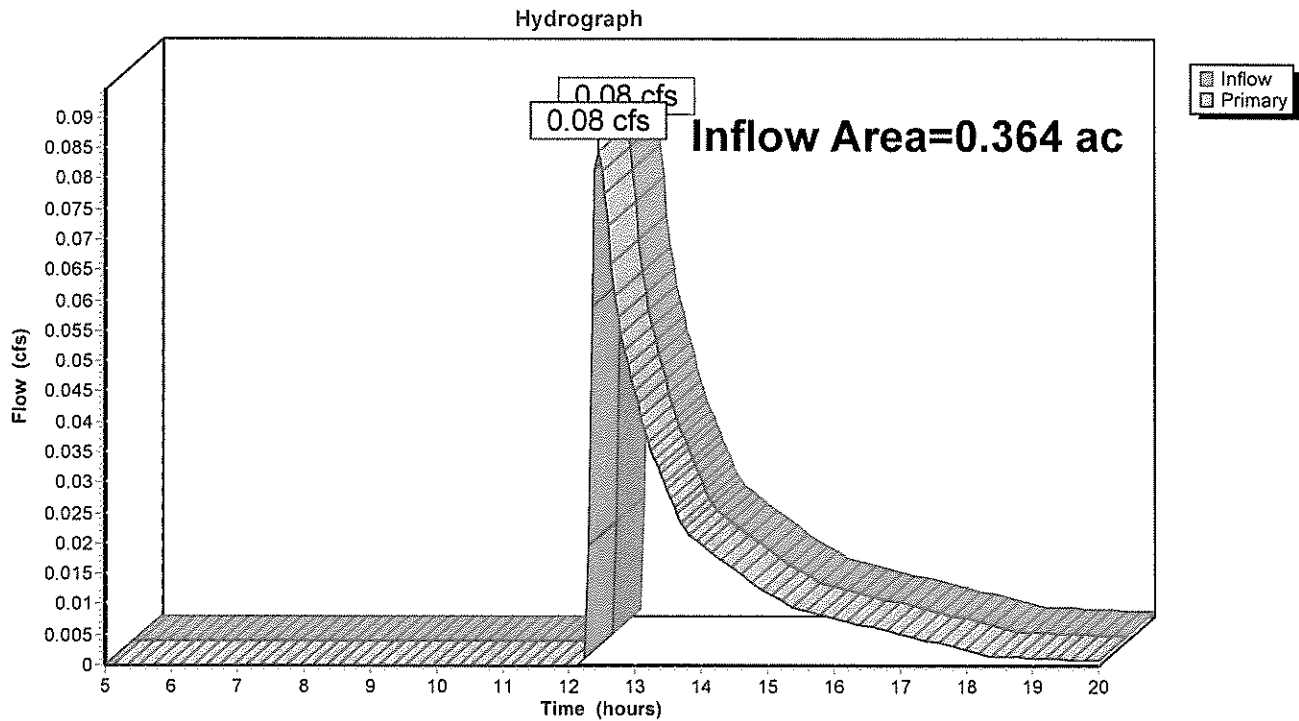


Summary for Link CB3: Design Point - Municipal Catch Basin in Millbury Street

Inflow Area = 0.364 ac, 0.00% Impervious, Inflow Depth > 0.30" for 2-Year event
 Inflow = 0.08 cfs @ 12.45 hrs, Volume= 0.009 af
 Primary = 0.08 cfs @ 12.45 hrs, Volume= 0.009 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link CB3: Design Point - Municipal Catch Basin in Millbury Street

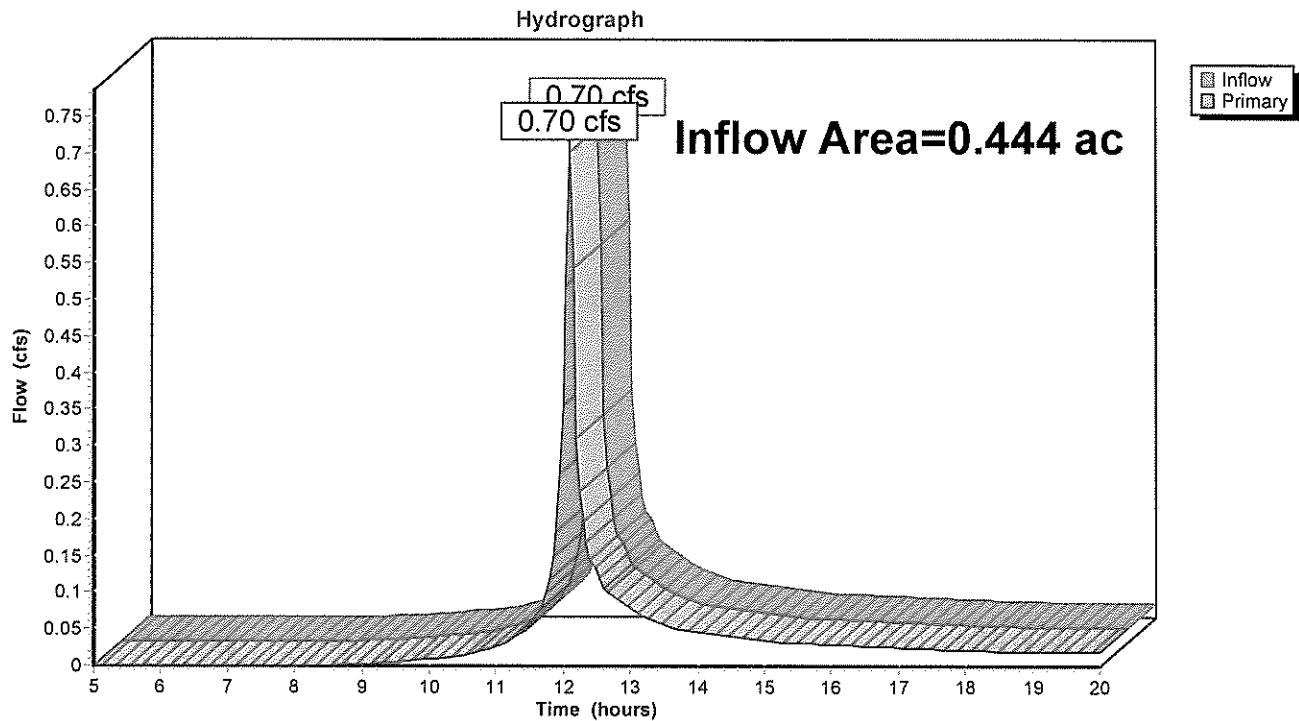


Summary for Link MS: Design Point - Millbury Street

Inflow Area = 0.444 ac, 20.50% Impervious, Inflow Depth > 1.20" for 2-Year event
 Inflow = 0.70 cfs @ 12.10 hrs, Volume= 0.044 af
 Primary = 0.70 cfs @ 12.10 hrs, Volume= 0.044 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link MS: Design Point - Millbury Street



Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
 Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
 Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1089: Current 2020 Runoff Area=35,229 sf 11.27% Impervious Runoff Depth>3.25"
 Flow Length=259' Tc=10.5 min CN=90 Runoff=2.53 cfs 0.219 af

Subcatchment P-A: Poposed 2021 Runoff Area=15,871 sf 0.00% Impervious Runoff Depth>1.95"
 Flow Length=117' Tc=4.3 min CN=75 Runoff=0.91 cfs 0.059 af

Subcatchment P-B: Poposed 2021 Runoff Area=19,358 sf 20.50% Impervious Runoff Depth>2.36"
 Flow Length=139' Tc=3.8 min CN=80 Runoff=1.36 cfs 0.087 af

Reach DL: 12" D PVC Drail Line to CB2 Avg. Flow Depth=0.25' Max Vel=5.33 fps Inflow=0.83 cfs 0.039 af
 12.0" Round Pipe n=0.010 L=151.0' S=0.0166 '/' Capacity=5.96 cfs Outflow=0.81 cfs 0.039 af

Pond CB1: Catch Basin 1 Peak Elev=446.04' Inflow=0.91 cfs 0.059 af
 12.0" Round Culvert n=0.010 L=5.0' S=0.0200 '/' Outflow=0.91 cfs 0.059 af

Pond CB2: Catch Basin Peak Elev=448.17' Inflow=0.83 cfs 0.039 af
 12.0" Round Culvert n=0.010 L=171.0' S=0.0287 '/' Outflow=0.83 cfs 0.039 af

Pond IT: Interceptor?RechargeTrench Peak Elev=447.05' Storage=491 cf Inflow=0.91 cfs 0.059 af
 Discarded=0.01 cfs 0.012 af Primary=0.83 cfs 0.039 af Outflow=0.85 cfs 0.051 af

Link C-M.S.: Design Point - Current Conditions - Millbury Street Inflow=2.53 cfs 0.219 af
 Primary=2.53 cfs 0.219 af

Link CB3: Design Point - Municipal Catch Basin in Millbury Street Inflow=0.81 cfs 0.039 af
 Primary=0.81 cfs 0.039 af

Link MS: Design Point - Millbury Street Inflow=1.36 cfs 0.087 af
 Primary=1.36 cfs 0.087 af

Total Runoff Area = 1.617 ac Runoff Volume = 0.366 af Average Runoff Depth = 2.71"
88.73% Pervious = 1.435 ac 11.27% Impervious = 0.182 ac

Summary for Subcatchment 1089: Current 2020 Conditions 1087-1089 Millbury St. TOTAL LOT

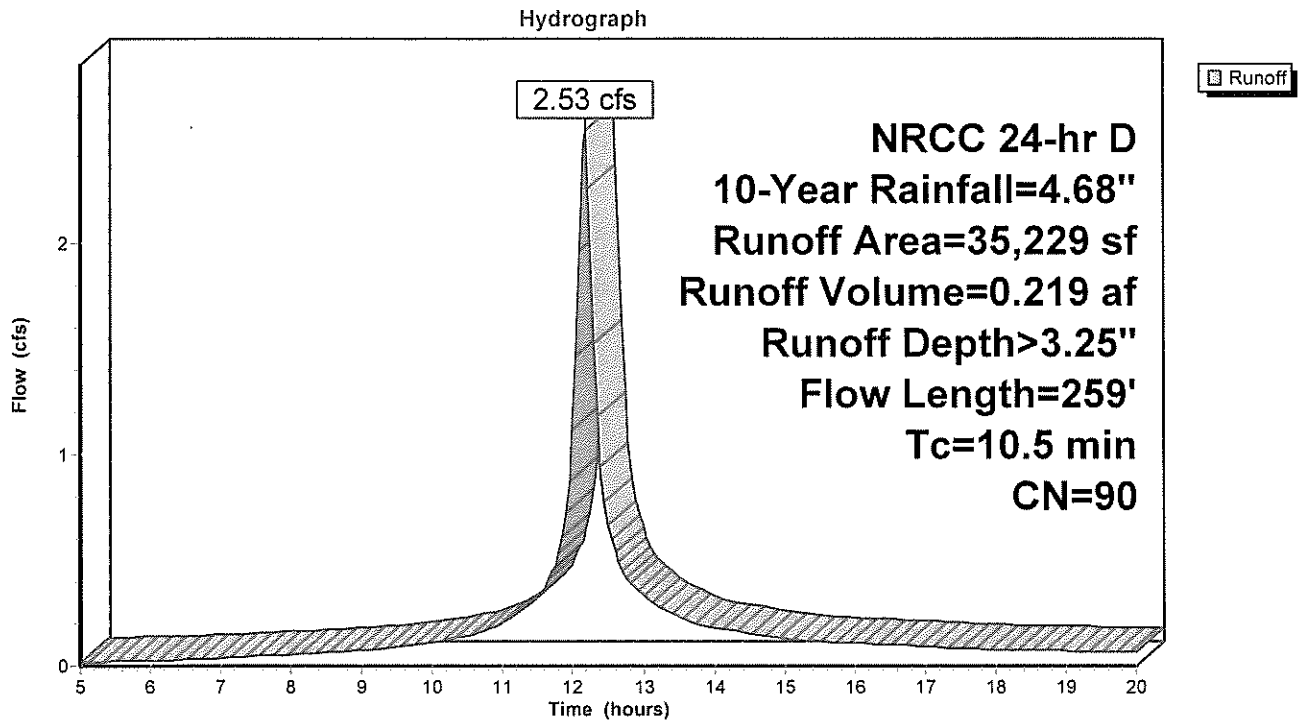
Runoff = 2.53 cfs @ 12.18 hrs, Volume= 0.219 af, Depth> 3.25"
 Routed to Link C-M.S. : Design Point - Current Conditions - Millbury Street

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 NRCC 24-hr D 10-Year Rainfall=4.68"

Area (sf)	CN	Description
1,900	70	Woods, Good, HSG C
820	74	>75% Grass cover, Good, HSG C
* 1,824	98	House Roofs
* 2,145	98	Pavement
* 2,200	83	Boulders
26,340	91	Fallow, bare soil, HSG C
35,229	90	Weighted Average
31,260		88.73% Pervious Area
3,969		11.27% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.8	32	0.0600	0.05		Sheet Flow, Sheet Flow Woods: Dense underbrush n= 0.800 P2= 3.13"
0.1	73	0.4500	10.80		Shallow Concentrated Flow, Shallow Concentrated Unpaved Kv= 16.1 fps
0.6	154	0.0840	4.67		Shallow Concentrated Flow, Shallow Concentrated Unpaved Kv= 16.1 fps
10.5	259	Total			

Subcatchment 1089: Current 2020 Conditions 1087-1089 Millbury St. TOTAL LOT



ary for Subcatchment P-A: Poposed 2021 Conditions 1087-1089 Millbury St. Upper Section to Dra

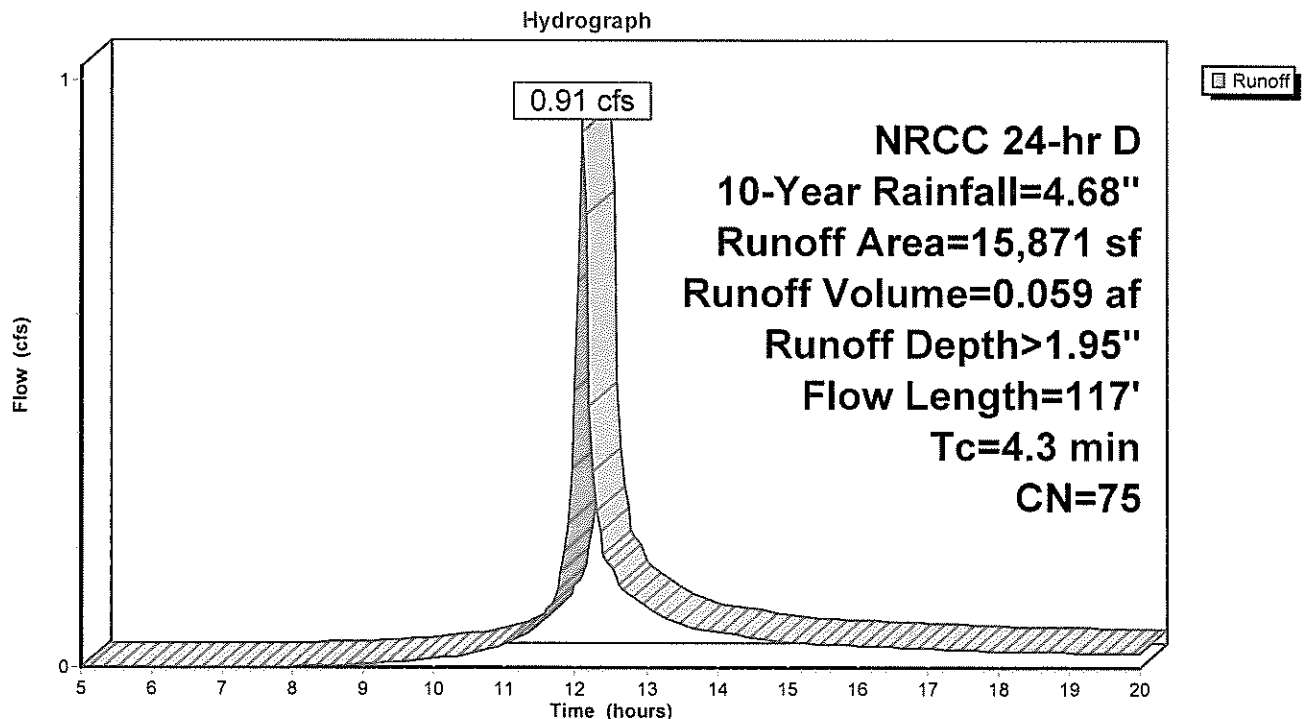
Runoff = 0.91 cfs @ 12.11 hrs, Volume= 0.059 af, Depth> 1.95"
 Routed to Pond CB1 : Catch Basin 1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 NRCC 24-hr D 10-Year Rainfall=4.68"

Area (sf)	CN	Description
1,913	70	Woods, Good, HSG C
11,343	74	>75% Grass cover, Good, HSG C
* 2,615	83	Boulders
15,871	75	Weighted Average
15,871		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.4	10	0.2000	0.07		Sheet Flow, Sheet Flow-1 Trees
					Woods: Dense underbrush n= 0.800 P2= 3.13"
1.6	40	0.3000	0.41		Sheet Flow, Sheet Flow 2 - Grass
					Grass: Short n= 0.150 P2= 3.13"
0.3	67	0.3000	3.83		Shallow Concentrated Flow, Shallow Concentrated
					Short Grass Pasture Kv= 7.0 fps
4.3	117	Total			

Subcatchment P-A: Poposed 2021 Conditions 1087-1089 Millbury St. Upper Section to Drain Syst



ry for Subcatchment P-B: Poposed 2021 Conditions 1087-1089 Millbury St. Lower Section To Mill

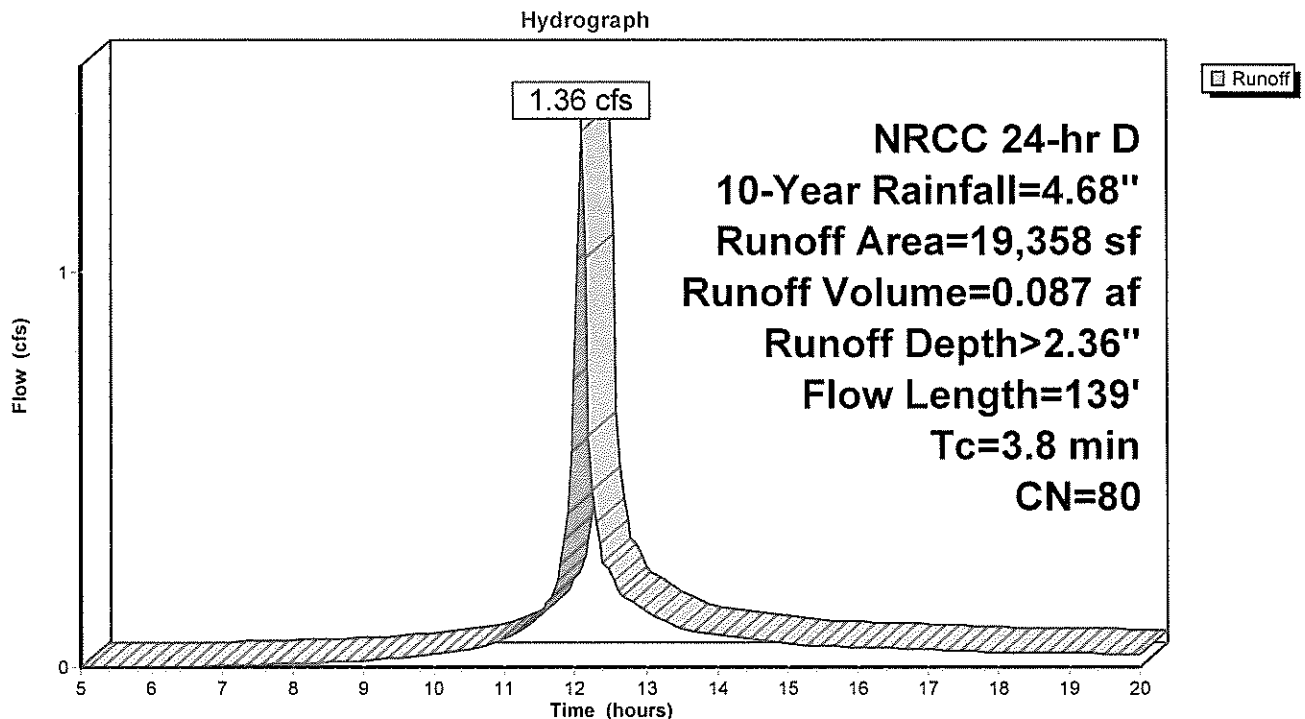
Runoff = 1.36 cfs @ 12.10 hrs, Volume= 0.087 af, Depth> 2.36"
 Routed to Link MS : Design Point - Millbury Street

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 NRCC 24-hr D 10-Year Rainfall=4.68"

	Area (sf)	CN	Description
	14,010	74	>75% Grass cover, Good, HSG C
*	1,824	98	House Roofs
*	2,145	98	Pavement
*	1,379	83	Boulders
	19,358	80	Weighted Average
	15,389		79.50% Pervious Area
	3,969		20.50% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.0	50	0.1000	0.28		Sheet Flow, Sheet Flow - Grass
					Grass: Short n= 0.150 P2= 3.13"
0.8	89	0.0700	1.85		Shallow Concentrated Flow, Shallow Concentrated
					Short Grass Pasture Kv= 7.0 fps
3.8	139	Total			

Subcatchment P-B: Poposed 2021 Conditions 1087-1089 Millbury St. Lower Section To Millbury St



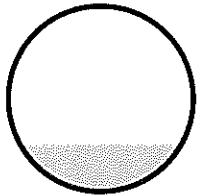
Summary for Reach DL: 12" D PVC Drail Line to CB2 in Millbury Street & Municipal Sewer

Inflow Area = 0.364 ac, 0.00% Impervious, Inflow Depth > 1.28" for 10-Year event
 Inflow = 0.83 cfs @ 12.14 hrs, Volume= 0.039 af
 Outflow = 0.81 cfs @ 12.15 hrs, Volume= 0.039 af, Atten= 3%, Lag= 0.7 min
 Routed to Link CB3 : Design Point - Municipal Catch Basin in Millbury Street

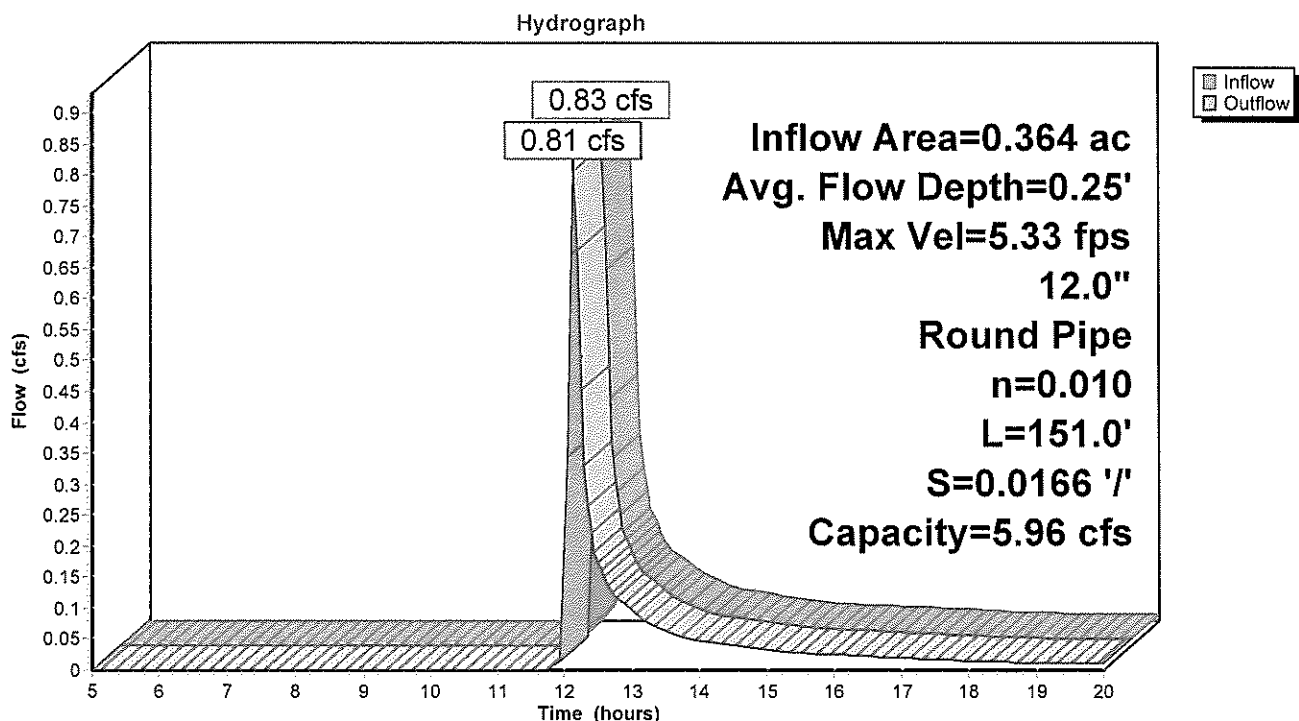
Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 Max. Velocity= 5.33 fps, Min. Travel Time= 0.5 min
 Avg. Velocity= 2.10 fps, Avg. Travel Time= 1.2 min

Peak Storage= 23 cf @ 12.14 hrs
 Average Depth at Peak Storage= 0.25' , Surface Width= 0.87'
 Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 5.96 cfs

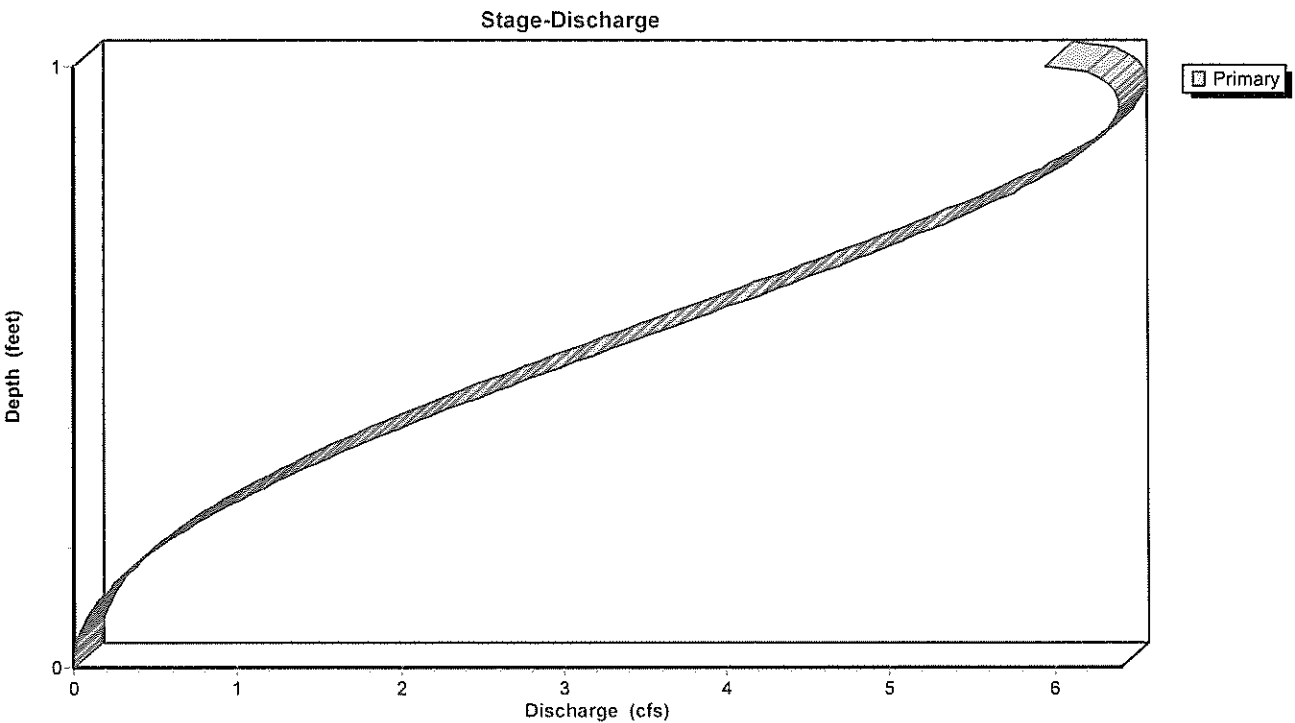
12.0" Round Pipe
 n= 0.010
 Length= 151.0' Slope= 0.0166 '/'
 Inlet Invert= 444.70', Outlet Invert= 442.20'



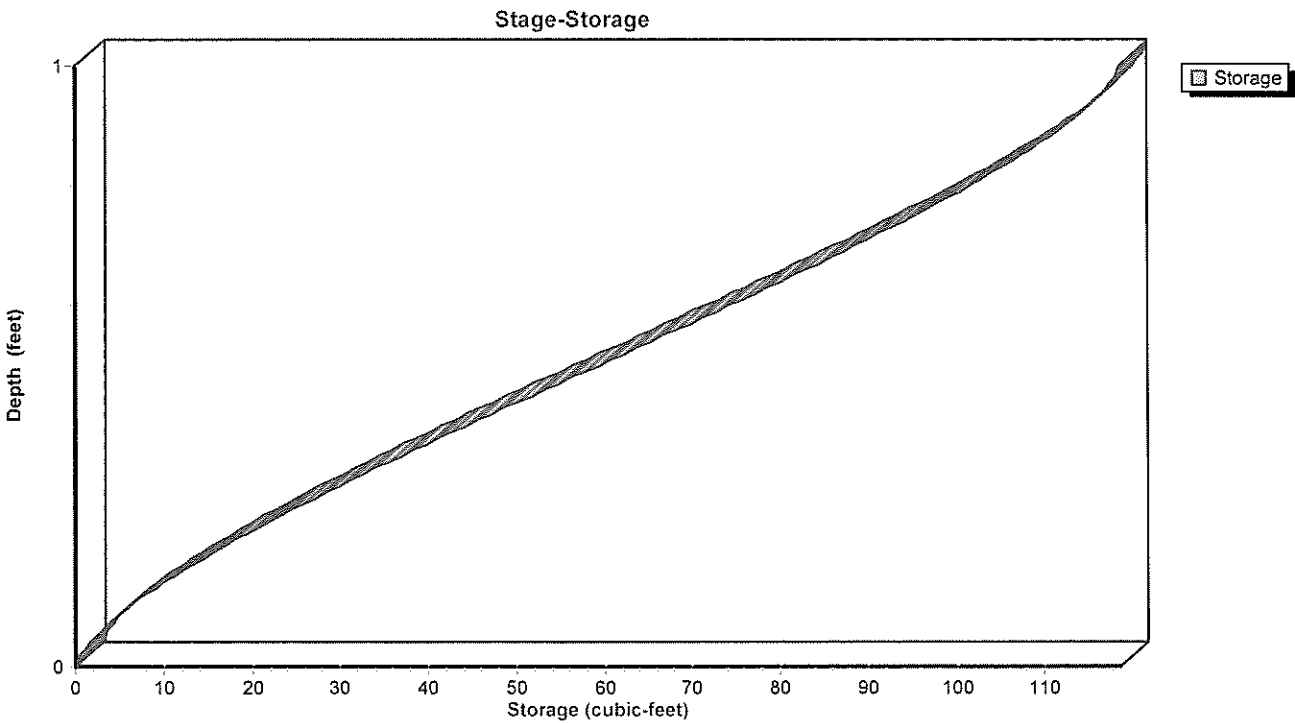
Reach DL: 12" D PVC Drail Line to CB2 in Millbury Street & Municipal Sewer



Reach DL: 12" D PVC Drail Line to CB2 in Millbury Street & Municipal Sewer



Reach DL: 12" D PVC Drail Line to CB2 in Millbury Street & Municipal Sewer



Summary for Pond CB1: Catch Basin 1

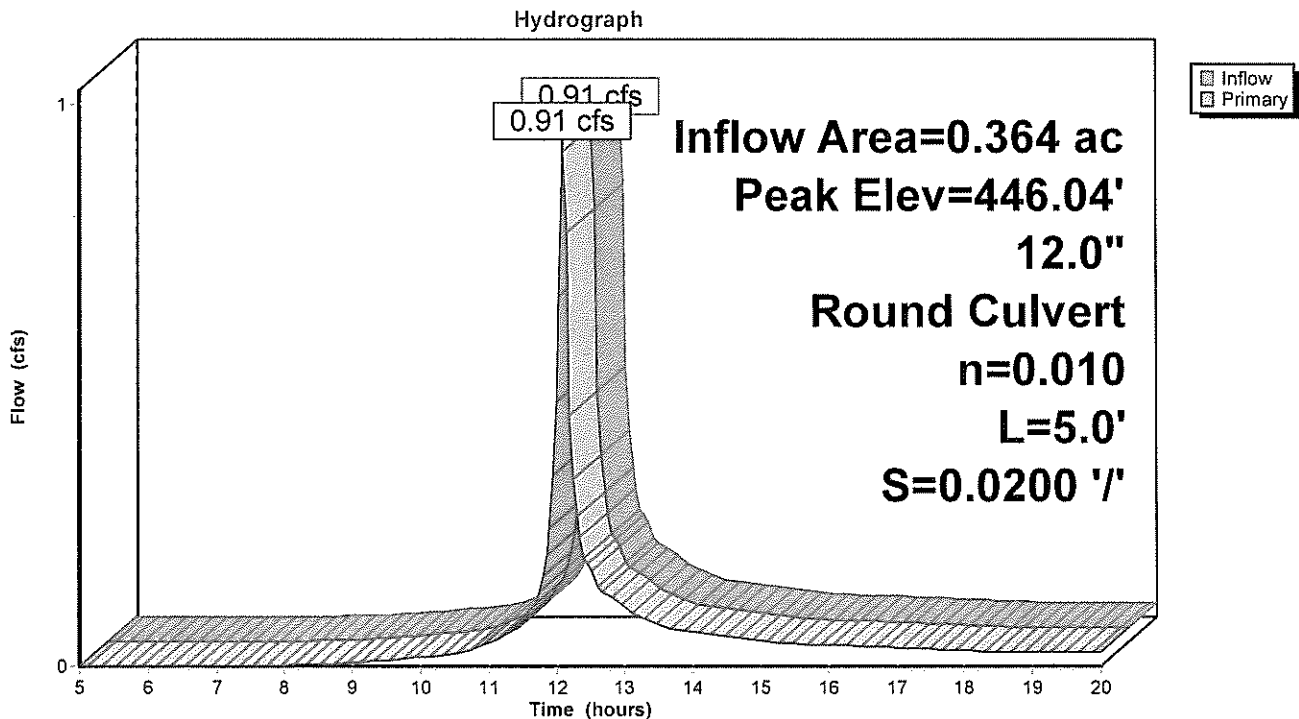
Inflow Area = 0.364 ac, 0.00% Impervious, Inflow Depth > 1.95" for 10-Year event
 Inflow = 0.91 cfs @ 12.11 hrs, Volume= 0.059 af
 Outflow = 0.91 cfs @ 12.11 hrs, Volume= 0.059 af, Atten= 0%, Lag= 0.0 min
 Primary = 0.91 cfs @ 12.11 hrs, Volume= 0.059 af
 Routed to Pond IT : Interceptor?Recharge Trench

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 Peak Elev= 446.04' @ 12.11 hrs

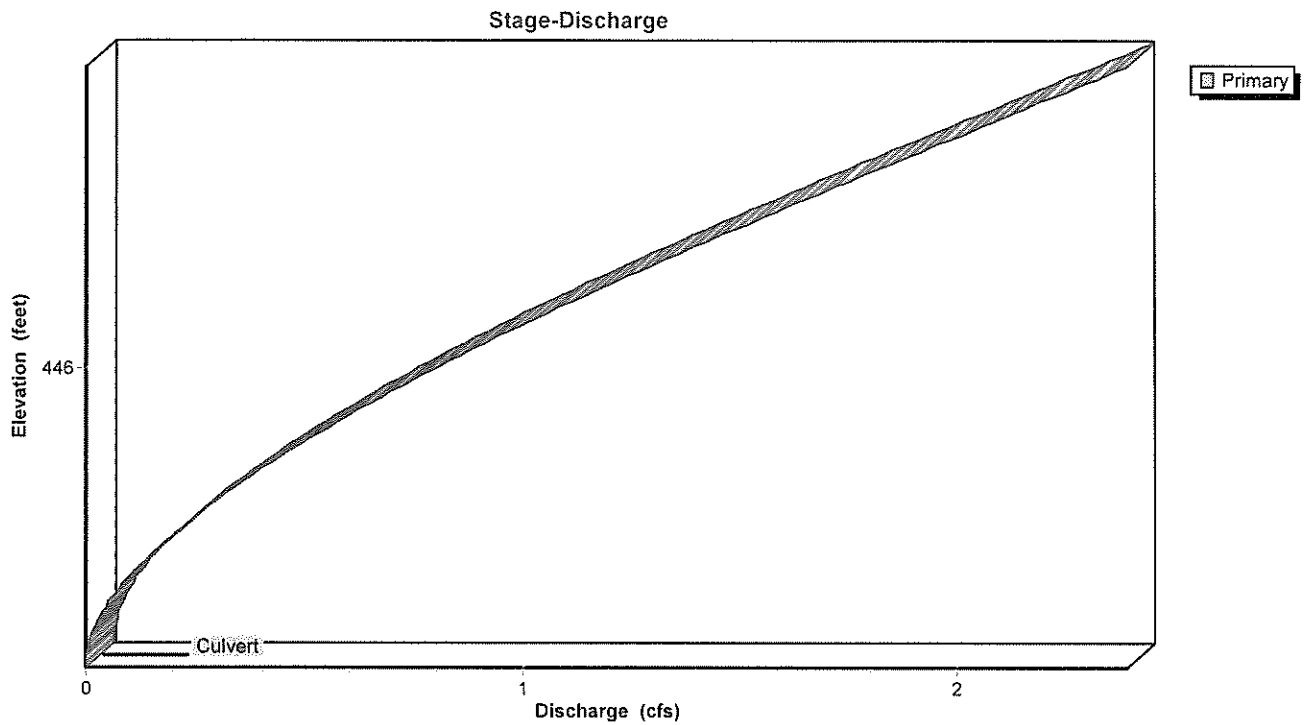
Device	Routing	Invert	Outlet Devices
#1	Primary	445.50'	12.0" Round Culvert L= 5.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 445.50' / 445.40' S= 0.0200 '/ Cc= 0.900 n= 0.010, Flow Area= 0.79 sf

Primary OutFlow Max=0.89 cfs @ 12.11 hrs HW=446.03' (Free Discharge)
 1=Culvert (Barrel Controls 0.89 cfs @ 3.05 fps)

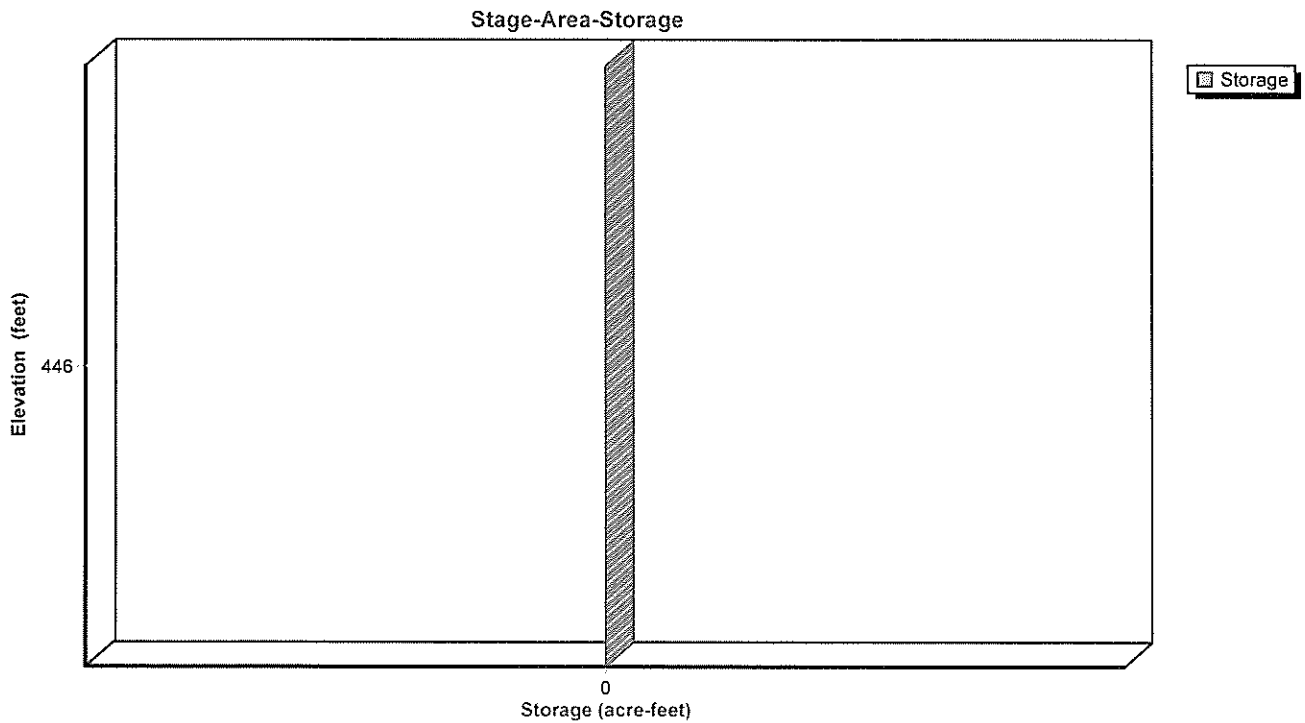
Pond CB1: Catch Basin 1



Pond CB1: Catch Basin 1



Pond CB1: Catch Basin 1



Summary for Pond CB2: Catch Basin

Inflow Area = 0.364 ac, 0.00% Impervious, Inflow Depth > 1.28" for 10-Year event
 Inflow = 0.83 cfs @ 12.14 hrs, Volume= 0.039 af
 Outflow = 0.83 cfs @ 12.14 hrs, Volume= 0.039 af, Atten= 0%, Lag= 0.0 min
 Primary = 0.83 cfs @ 12.14 hrs, Volume= 0.039 af
 Routed to Reach DL : 12" D PVC Drail Line to CB2 in Millbury Street & Municipal Sewer

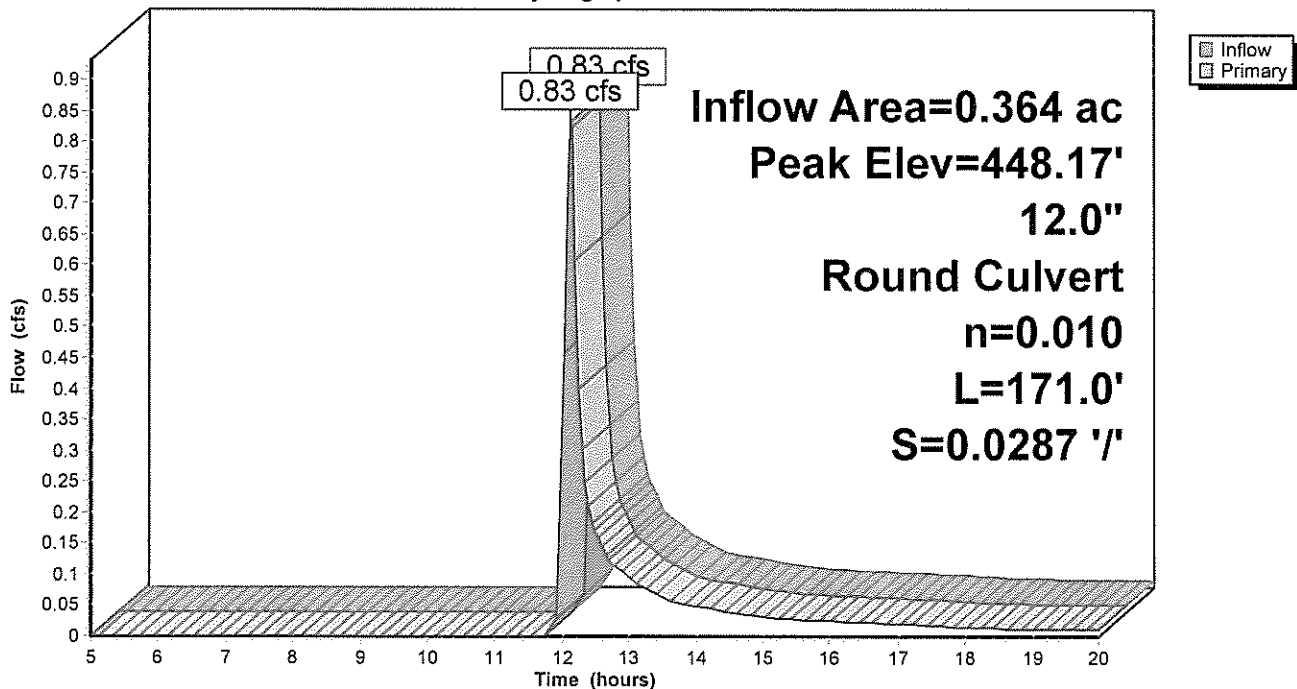
Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 Peak Elev= 448.17' @ 12.14 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	447.70'	12.0" Round Culvert L= 171.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 447.70' / 442.80' S= 0.0287 '/' Cc= 0.900 n= 0.010, Flow Area= 0.79 sf

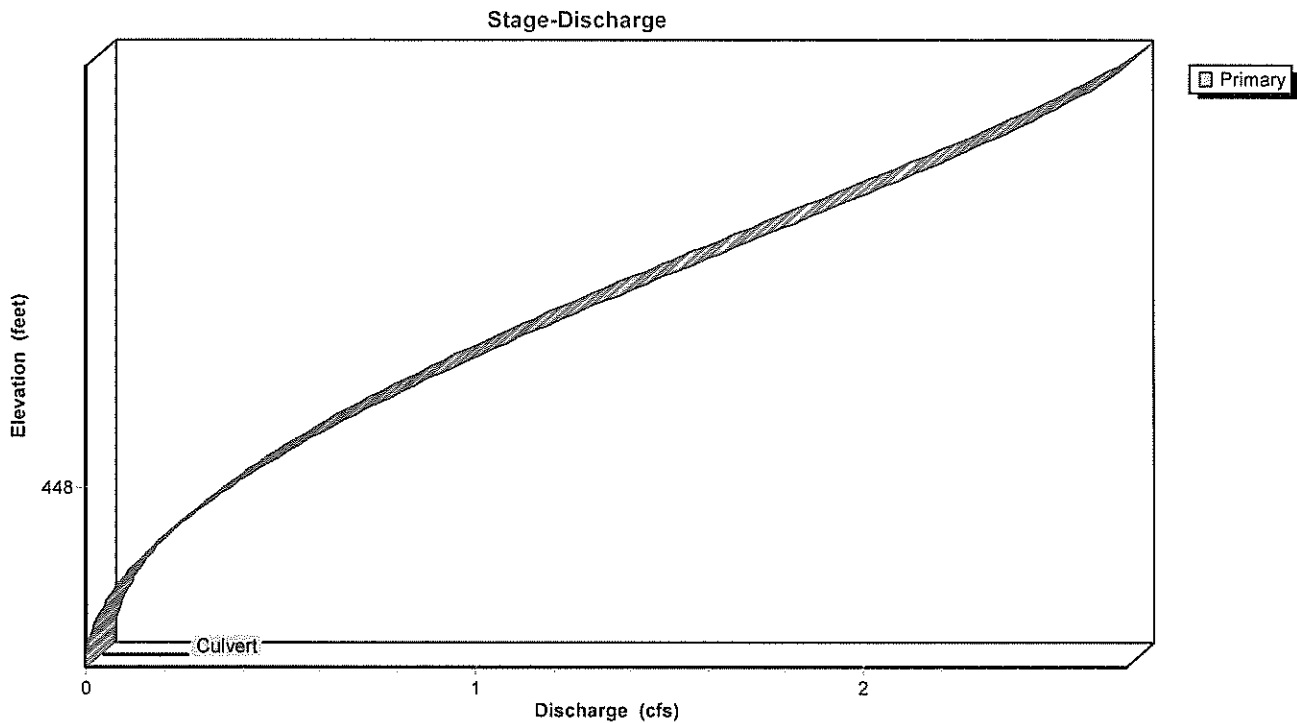
Primary OutFlow Max=0.81 cfs @ 12.14 hrs HW=448.16' (Free Discharge)
 1=Culvert (Inlet Controls 0.81 cfs @ 2.30 fps)

Pond CB2: Catch Basin

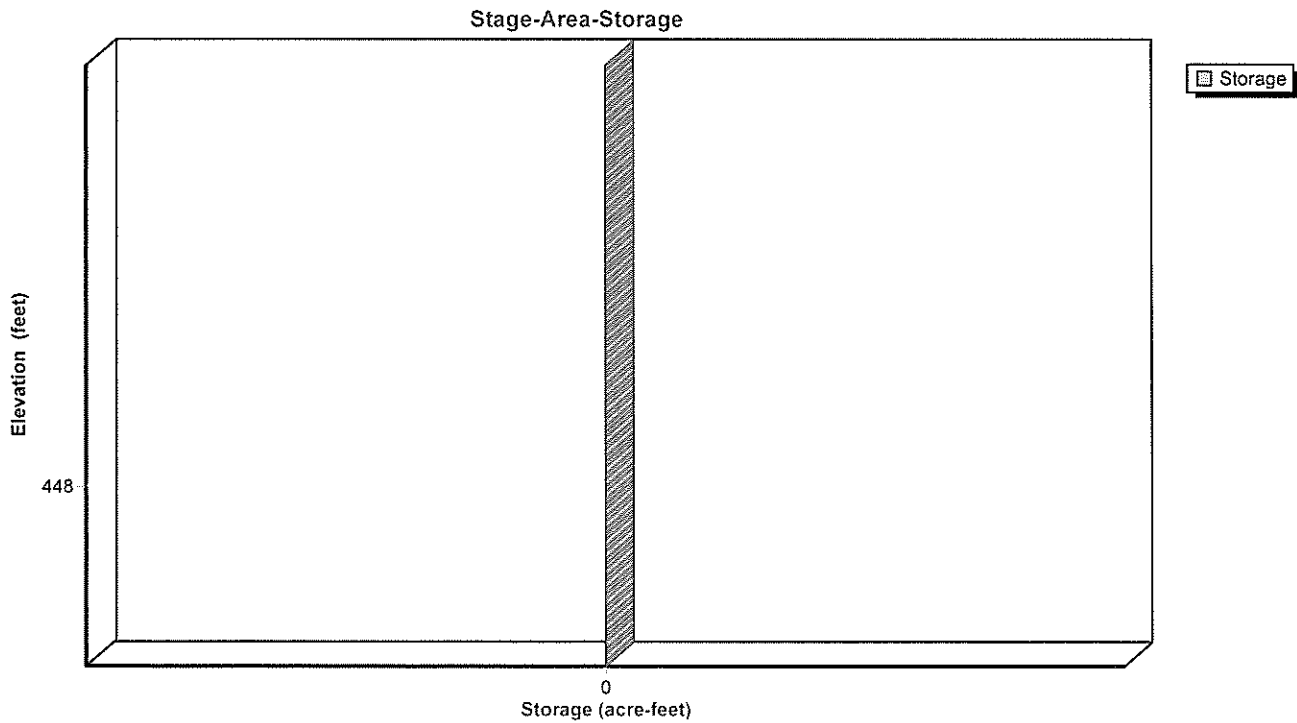
Hydrograph



Pond CB2: Catch Basin



Pond CB2: Catch Basin



Summary for Pond IT: Interceptor?Recharge Trench

Inflow Area = 0.364 ac, 0.00% Impervious, Inflow Depth > 1.95" for 10-Year event
 Inflow = 0.91 cfs @ 12.11 hrs, Volume= 0.059 af
 Outflow = 0.85 cfs @ 12.14 hrs, Volume= 0.051 af, Atten= 8%, Lag= 1.9 min
 Discarded = 0.01 cfs @ 10.05 hrs, Volume= 0.012 af
 Primary = 0.83 cfs @ 12.14 hrs, Volume= 0.039 af
 Routed to Pond CB2 : Catch Basin

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 Peak Elev= 447.05' @ 12.14 hrs Surf.Area= 240 sf Storage= 491 cf

Plug-Flow detention time= 69.2 min calculated for 0.051 af (86% of inflow)
 Center-of-Mass det. time= 22.4 min (829.6 - 807.2)

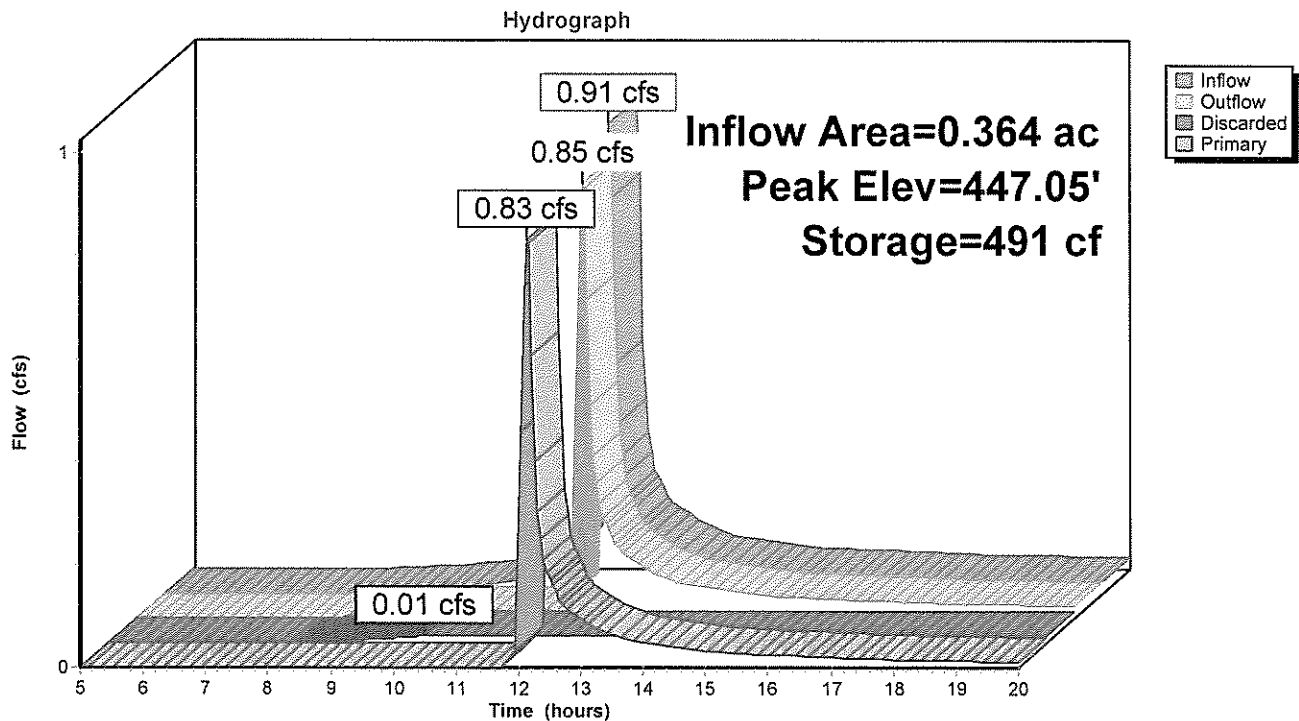
Volume	Invert	Avail.Storage	Storage Description
#1	445.00'	960 cf	3.00'W x 80.00'L x 4.00'H Prismatic

Device	Routing	Invert	Outlet Devices
#1	Discarded	445.00'	2.410 in/hr Exfiltration over Horizontal area
#2	Primary	446.50'	12.0" Round Culvert L= 5.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 446.50' / 446.40' S= 0.0200 '/ Cc= 0.900 n= 0.010, Flow Area= 0.79 sf

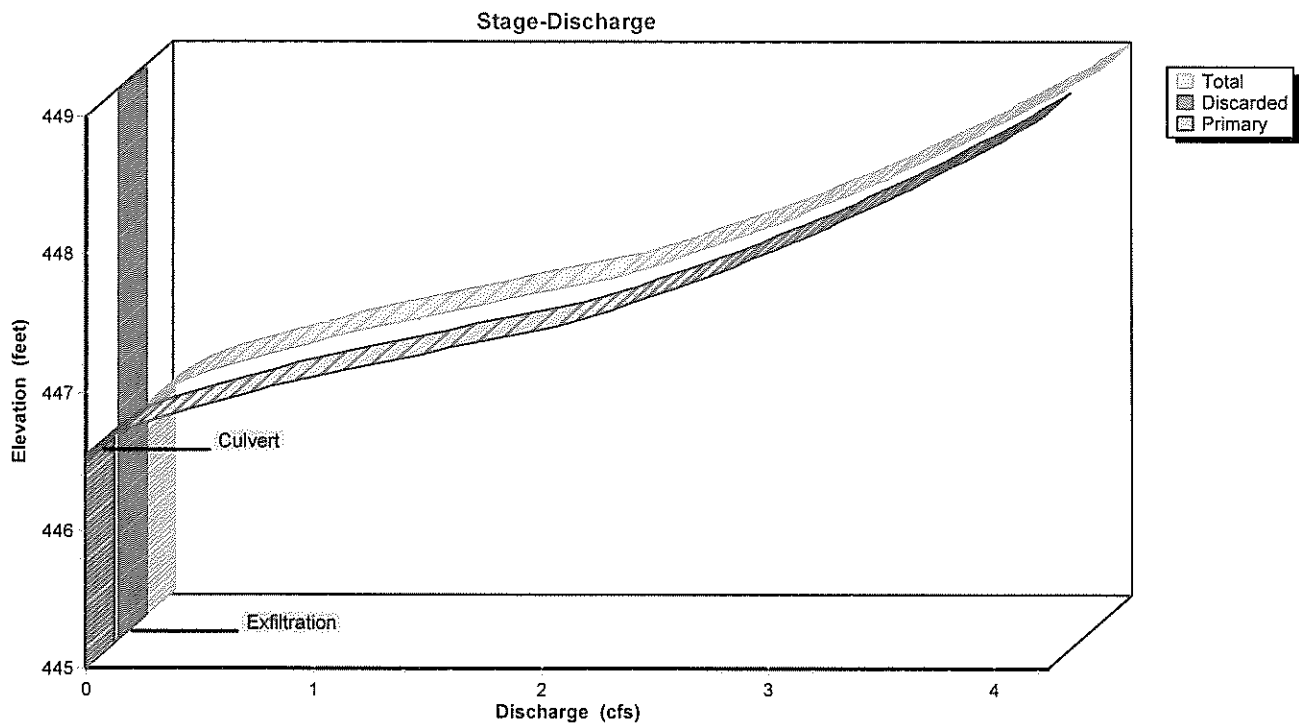
Discarded OutFlow Max=0.01 cfs @ 10.05 hrs HW=445.04' (Free Discharge)
 ↗1=Exfiltration (Exfiltration Controls 0.01 cfs)

Primary OutFlow Max=0.81 cfs @ 12.14 hrs HW=447.03' (Free Discharge)
 ↗2=Culvert (Barrel Controls 0.81 cfs @ 2.73 fps)

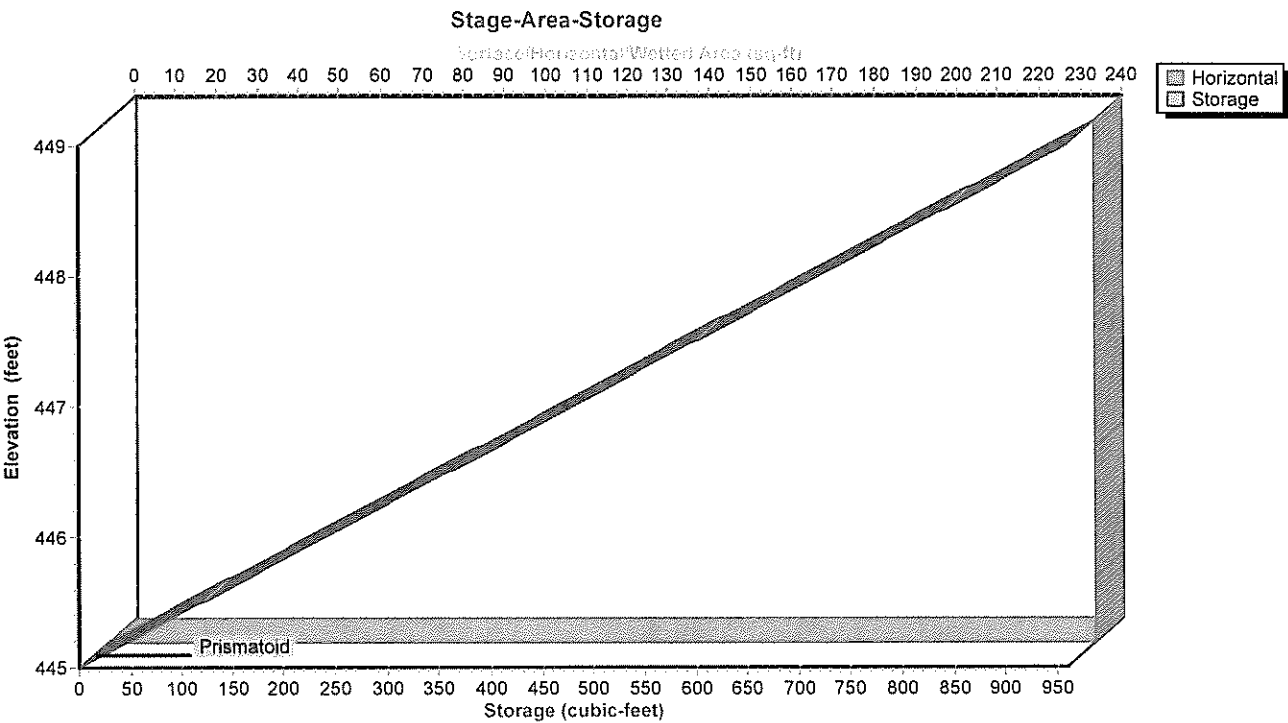
Pond IT: Interceptor?Recharge Trench



Pond IT: Interceptor?Recharge Trench



Pond IT: Interceptor?Recharge Trench

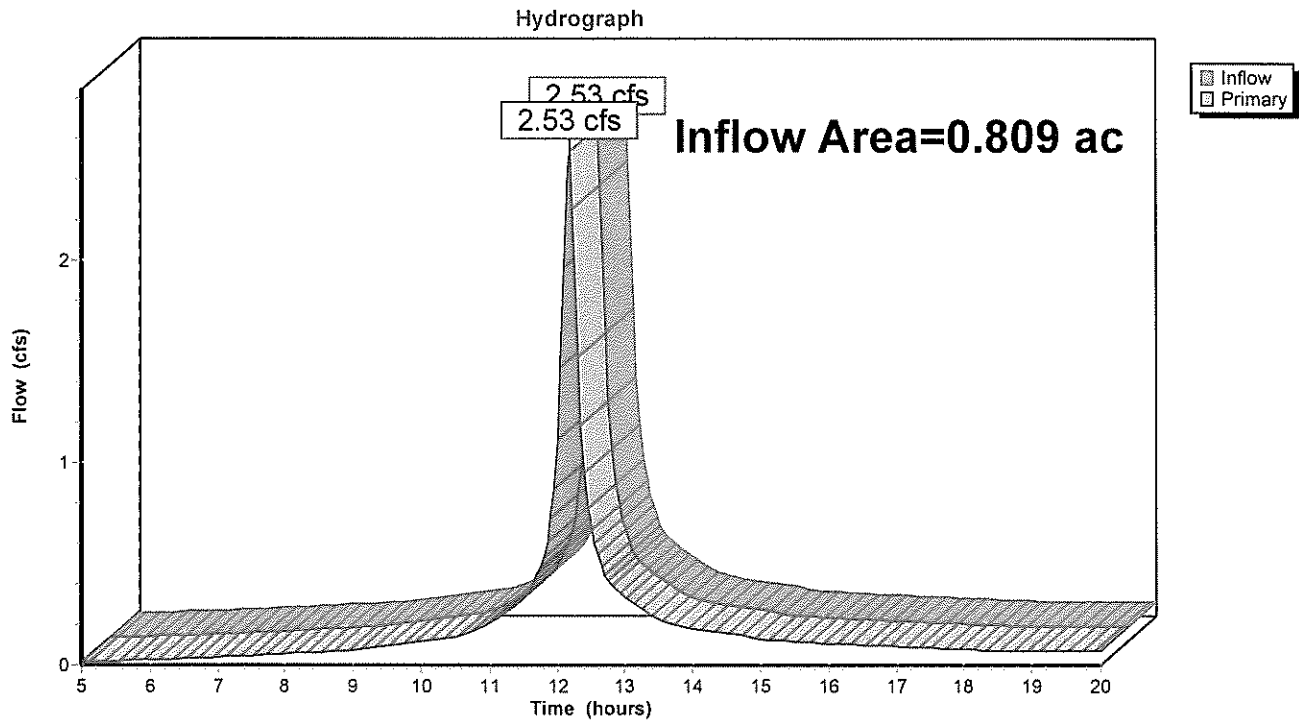


Summary for Link C-M.S.: Design Point - Current Conditions - Millbury Street

Inflow Area = 0.809 ac, 11.27% Impervious, Inflow Depth > 3.25" for 10-Year event
 Inflow = 2.53 cfs @ 12.18 hrs, Volume= 0.219 af
 Primary = 2.53 cfs @ 12.18 hrs, Volume= 0.219 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link C-M.S.: Design Point - Current Conditions - Millbury Street

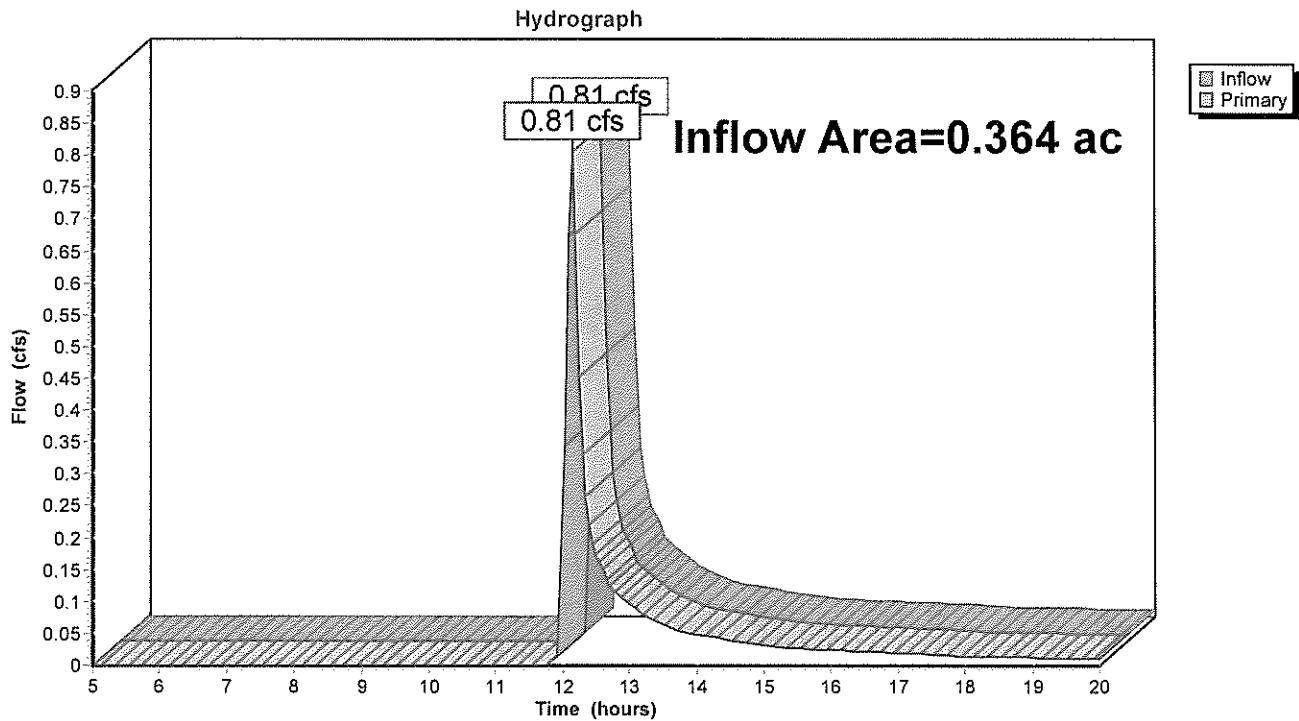


Summary for Link CB3: Design Point - Municipal Catch Basin in Millbury Street

Inflow Area = 0.364 ac, 0.00% Impervious, Inflow Depth > 1.27" for 10-Year event
 Inflow = 0.81 cfs @ 12.15 hrs, Volume= 0.039 af
 Primary = 0.81 cfs @ 12.15 hrs, Volume= 0.039 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link CB3: Design Point - Municipal Catch Basin in Millbury Street

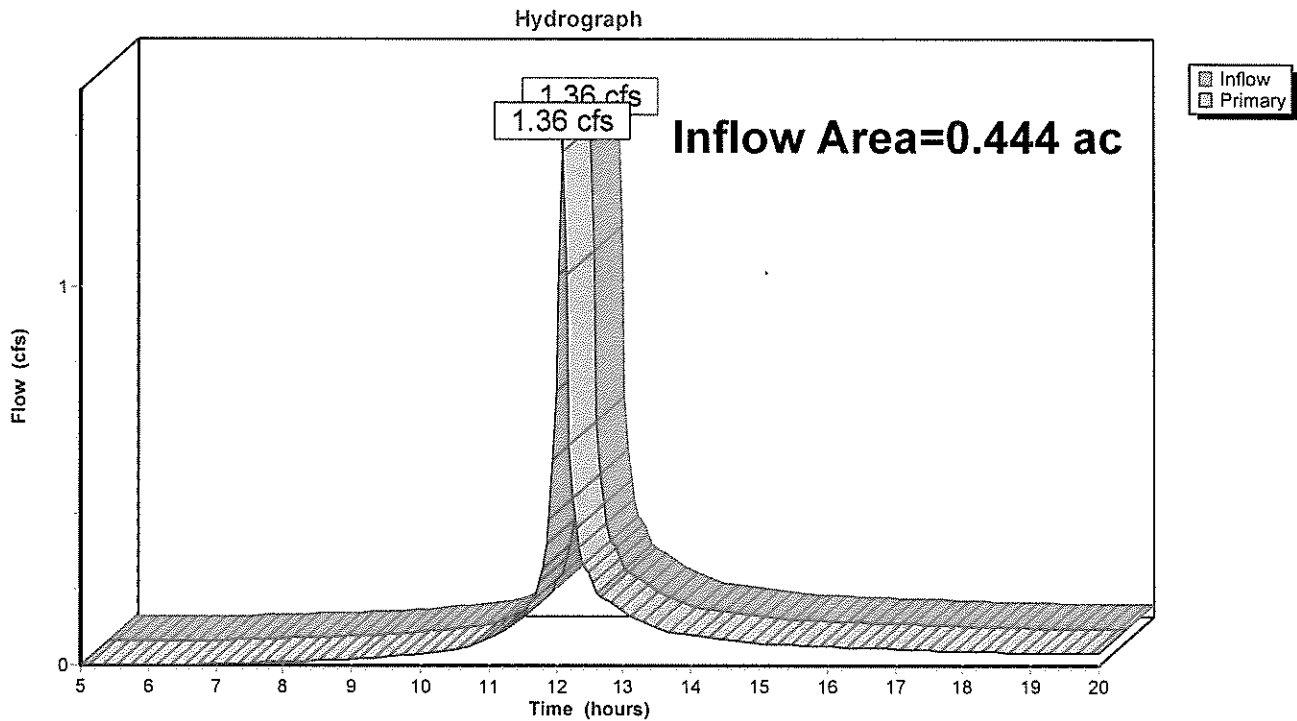


Summary for Link MS: Design Point - Millbury Street

Inflow Area = 0.444 ac, 20.50% Impervious, Inflow Depth > 2.36" for 10-Year event
 Inflow = 1.36 cfs @ 12.10 hrs, Volume= 0.087 af
 Primary = 1.36 cfs @ 12.10 hrs, Volume= 0.087 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link MS: Design Point - Millbury Street



Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
 Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
 Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1089: Current 2020 Runoff Area=35,229 sf 11.27% Impervious Runoff Depth>4.30"
 Flow Length=259' Tc=10.5 min CN=90 Runoff=3.30 cfs 0.290 af

Subcatchment P-A: Poposed 2021 Runoff Area=15,871 sf 0.00% Impervious Runoff Depth>2.86"
 Flow Length=117' Tc=4.3 min CN=75 Runoff=1.33 cfs 0.087 af

Subcatchment P-B: Poposed 2021 Runoff Area=19,358 sf 20.50% Impervious Runoff Depth>3.33"
 Flow Length=139' Tc=3.8 min CN=80 Runoff=1.89 cfs 0.123 af

Reach DL: 12" D PVC Drail Line to CB2 Avg. Flow Depth=0.31' Max Vel=5.96 fps Inflow=1.22 cfs 0.065 af
 12.0" Round Pipe n=0.010 L=151.0' S=0.0166 '/ Outflow=1.20 cfs 0.065 af

Pond CB1: Catch Basin 1 Peak Elev=446.18' Inflow=1.33 cfs 0.087 af
 12.0" Round Culvert n=0.010 L=5.0' S=0.0200 '/ Outflow=1.33 cfs 0.087 af

Pond CB2: Catch Basin Peak Elev=448.28' Inflow=1.22 cfs 0.065 af
 12.0" Round Culvert n=0.010 L=171.0' S=0.0287 '/ Outflow=1.22 cfs 0.065 af

Pond IT: Interceptor?RechargeTrench Peak Elev=447.19' Storage=526 cf Inflow=1.33 cfs 0.087 af
 Discarded=0.01 cfs 0.013 af Primary=1.22 cfs 0.065 af Outflow=1.24 cfs 0.078 af

Link C-M.S.: Design Point - Current Conditions - Millbury Street Inflow=3.30 cfs 0.290 af
 Primary=3.30 cfs 0.290 af

Link CB3: Design Point - Municipal Catch Basin in Millbury Street Inflow=1.20 cfs 0.065 af
 Primary=1.20 cfs 0.065 af

Link MS: Design Point - Millbury Street Inflow=1.89 cfs 0.123 af
 Primary=1.89 cfs 0.123 af

Total Runoff Area = 1.617 ac Runoff Volume = 0.500 af Average Runoff Depth = 3.71"
88.73% Pervious = 1.435 ac 11.27% Impervious = 0.182 ac

Summary for Subcatchment 1089: Current 2020 Conditions 1087-1089 Millbury St. TOTAL LOT

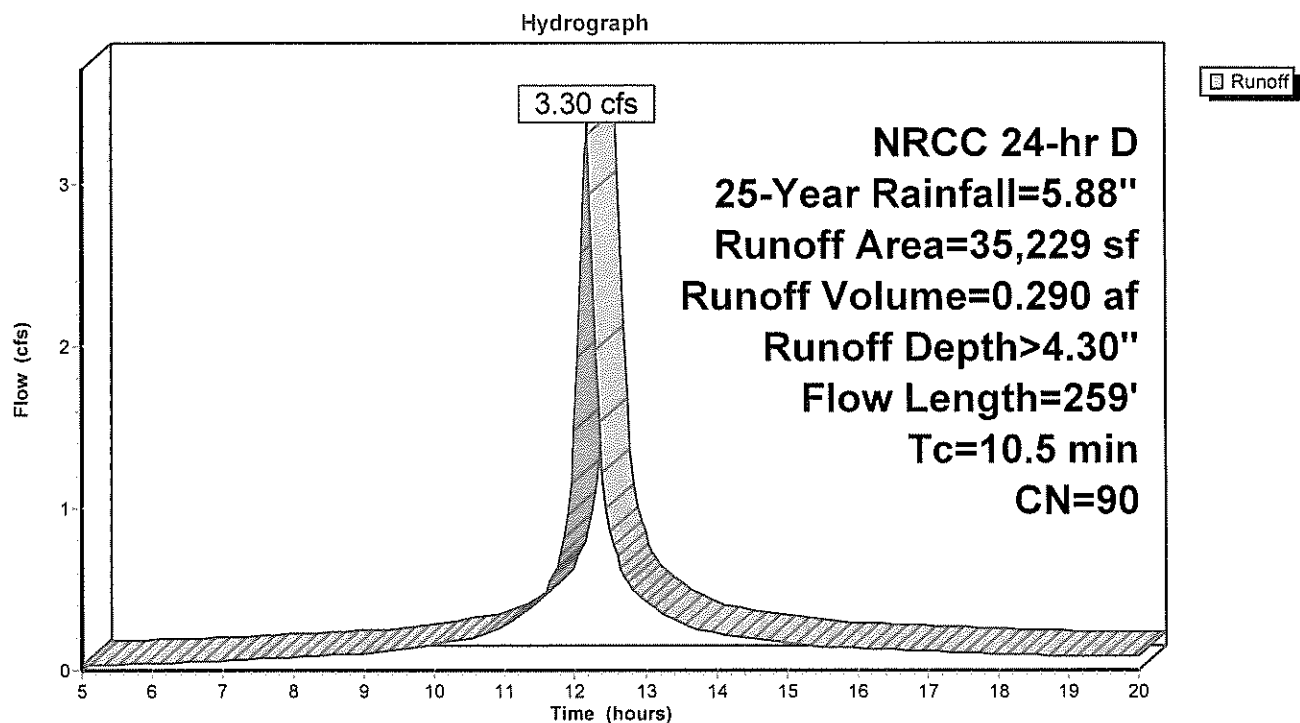
Runoff = 3.30 cfs @ 12.18 hrs, Volume= 0.290 af, Depth> 4.30"
 Routed to Link C-M.S. : Design Point - Current Conditions - Millbury Street

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 NRCC 24-hr D 25-Year Rainfall=5.88"

Area (sf)	CN	Description
1,900	70	Woods, Good, HSG C
820	74	>75% Grass cover, Good, HSG C
* 1,824	98	House Roofs
* 2,145	98	Pavement
* 2,200	83	Boulders
26,340	91	Fallow, bare soil, HSG C
35,229	90	Weighted Average
31,260		88.73% Pervious Area
3,969		11.27% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.8	32	0.0600	0.05		Sheet Flow, Sheet Flow Woods: Dense underbrush n= 0.800 P2= 3.13"
0.1	73	0.4500	10.80		Shallow Concentrated Flow, Shallow Concentrated Unpaved Kv= 16.1 fps
0.6	154	0.0840	4.67		Shallow Concentrated Flow, Shallo Concentrated Unpaved Kv= 16.1 fps
10.5	259	Total			

Subcatchment 1089: Current 2020 Conditions 1087-1089 Millbury St. TOTAL LOT



ary for Subcatchment P-A: Poposed 2021 Conditions 1087-1089 Millbury St. Upper Section to Dra

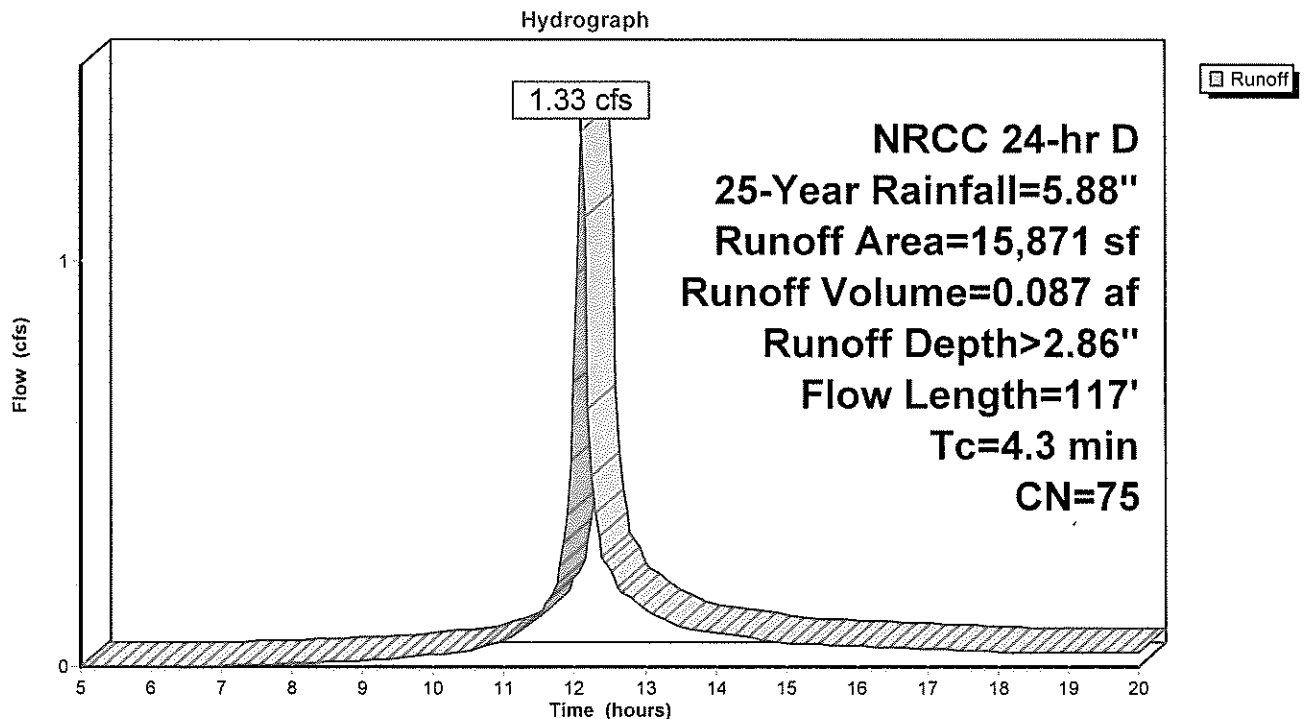
Runoff = 1.33 cfs @ 12.11 hrs, Volume= 0.087 af, Depth> 2.86"
 Routed to Pond CB1 : Catch Basin 1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 NRCC 24-hr D 25-Year Rainfall=5.88"

Area (sf)	CN	Description
1,913	70	Woods, Good, HSG C
11,343	74	>75% Grass cover, Good, HSG C
* 2,615	83	Boulders
15,871	75	Weighted Average
15,871		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.4	10	0.2000	0.07		Sheet Flow, Sheet Flow-1 Trees Woods: Dense underbrush n= 0.800 P2= 3.13"
1.6	40	0.3000	0.41		Sheet Flow, Sheet Flow 2 - Grass Grass: Short n= 0.150 P2= 3.13"
0.3	67	0.3000	3.83		Shallow Concentrated Flow, Shallow Concentrated Short Grass Pasture Kv= 7.0 fps
4.3	117	Total			

Subcatchment P-A: Poposed 2021 Conditions 1087-1089 Millbury St. Upper Section to Drain Syst



Hydrograph for Subcatchment P-B: Poposed 2021 Conditions 1087-1089 Millbury St. Lower Section To Millbury St

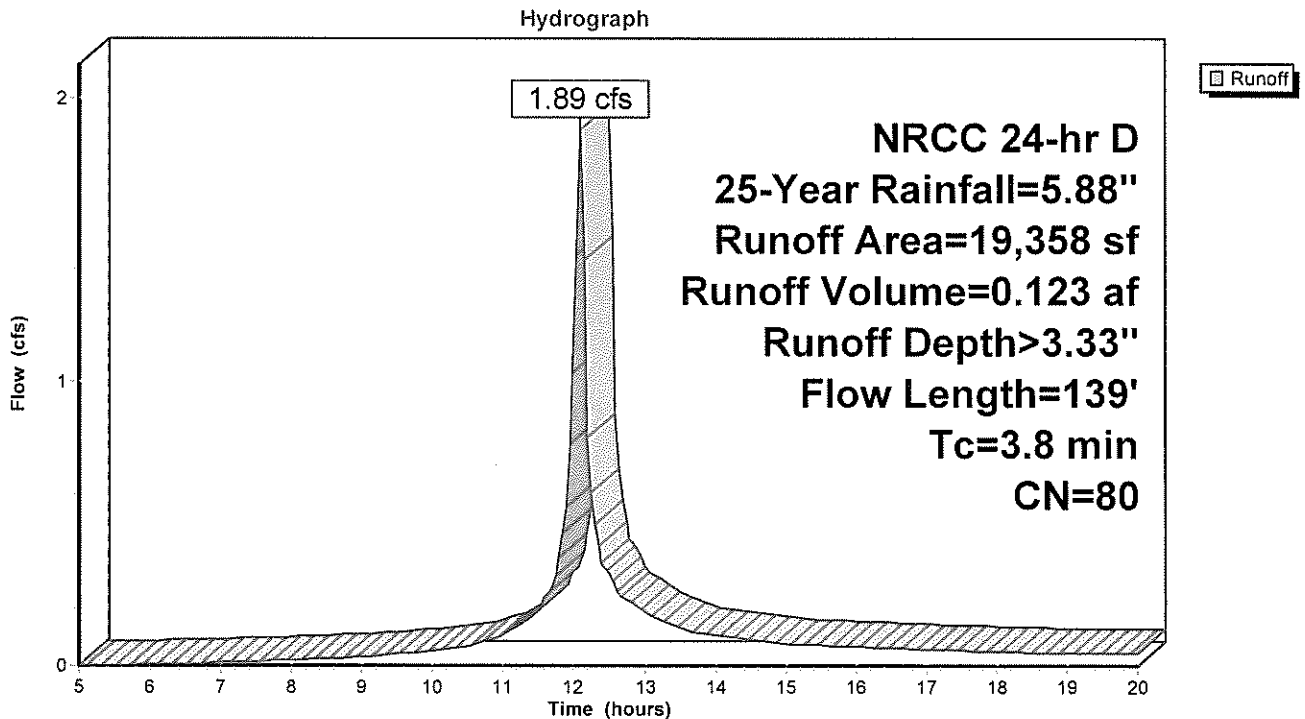
Runoff = 1.89 cfs @ 12.10 hrs, Volume= 0.123 af, Depth> 3.33"
 Routed to Link MS : Design Point - Millbury Street

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 NRCC 24-hr D 25-Year Rainfall=5.88"

Area (sf)	CN	Description
14,010	74	>75% Grass cover, Good, HSG C
* 1,824	98	House Roofs
* 2,145	98	Pavement
* 1,379	83	Boulders
19,358	80	Weighted Average
15,389		79.50% Pervious Area
3,969		20.50% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.0	50	0.1000	0.28		Sheet Flow, Sheet Flow - Grass
					Grass: Short n= 0.150 P2= 3.13"
0.8	89	0.0700	1.85		Shallow Concentrated Flow, Shallow Concentrated
					Short Grass Pasture Kv= 7.0 fps
3.8	139	Total			

Hydrograph for Subcatchment P-B: Poposed 2021 Conditions 1087-1089 Millbury St. Lower Section To Millbury St



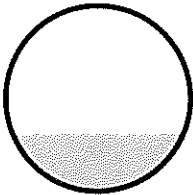
Summary for Reach DL: 12" D PVC Drail Line to CB2 in Millbury Street & Municipal Sewer

Inflow Area = 0.364 ac, 0.00% Impervious, Inflow Depth > 2.13" for 25-Year event
 Inflow = 1.22 cfs @ 12.13 hrs, Volume= 0.065 af
 Outflow = 1.20 cfs @ 12.14 hrs, Volume= 0.065 af, Atten= 2%, Lag= 0.6 min
 Routed to Link CB3 : Design Point - Municipal Catch Basin in Millbury Street

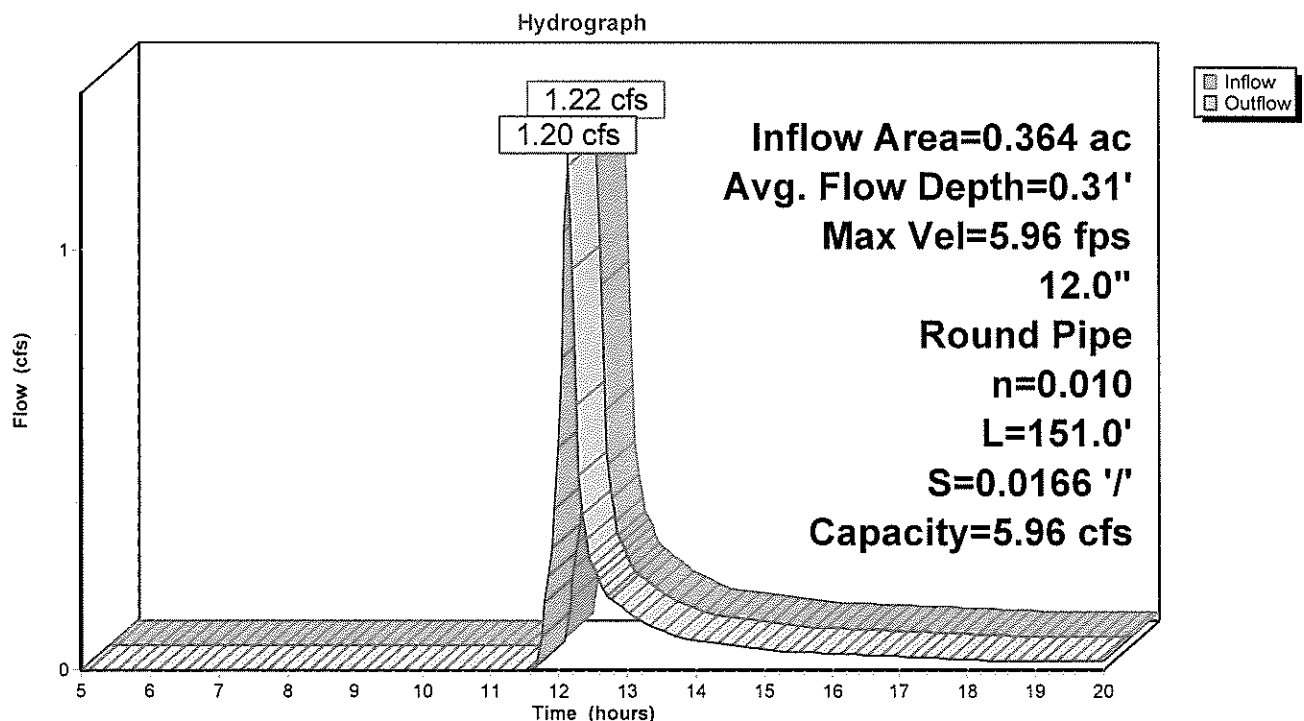
Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 Max. Velocity= 5.96 fps, Min. Travel Time= 0.4 min
 Avg. Velocity= 2.43 fps, Avg. Travel Time= 1.0 min

Peak Storage= 31 cf @ 12.14 hrs
 Average Depth at Peak Storage= 0.31' , Surface Width= 0.92'
 Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 5.96 cfs

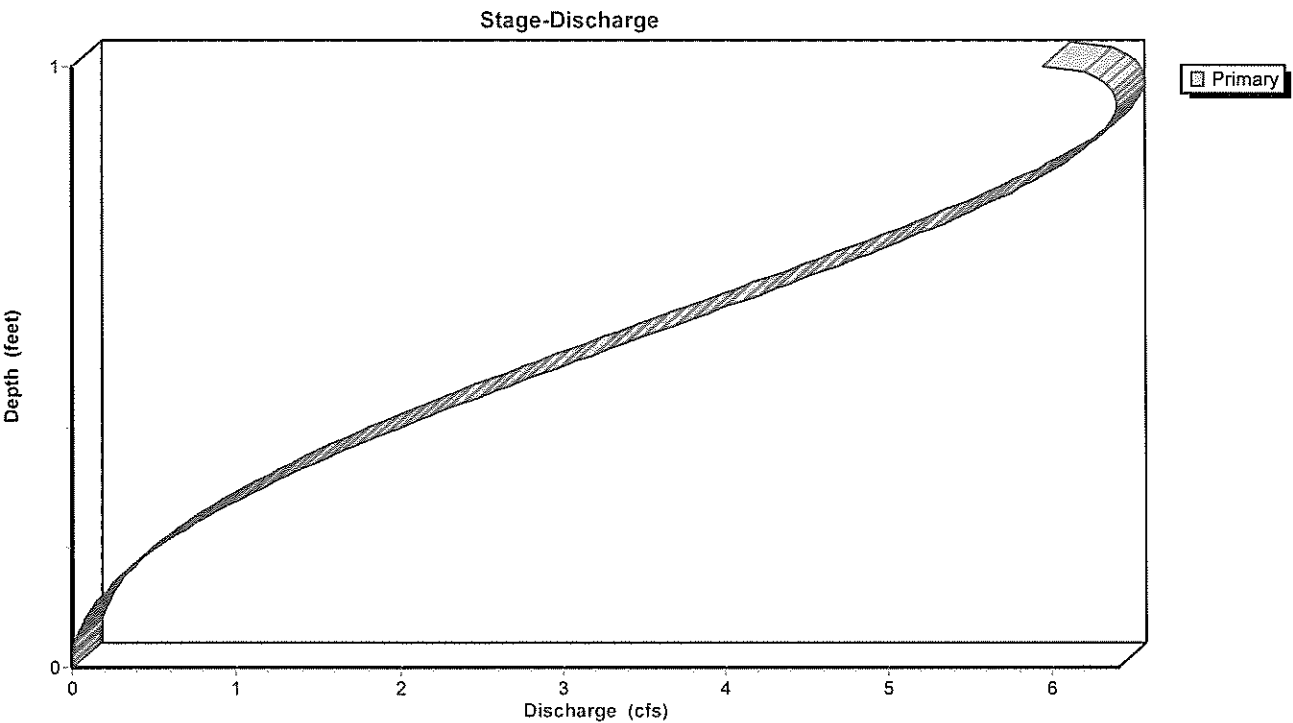
12.0" Round Pipe
 n= 0.010
 Length= 151.0' Slope= 0.0166 '/
 Inlet Invert= 444.70', Outlet Invert= 442.20'



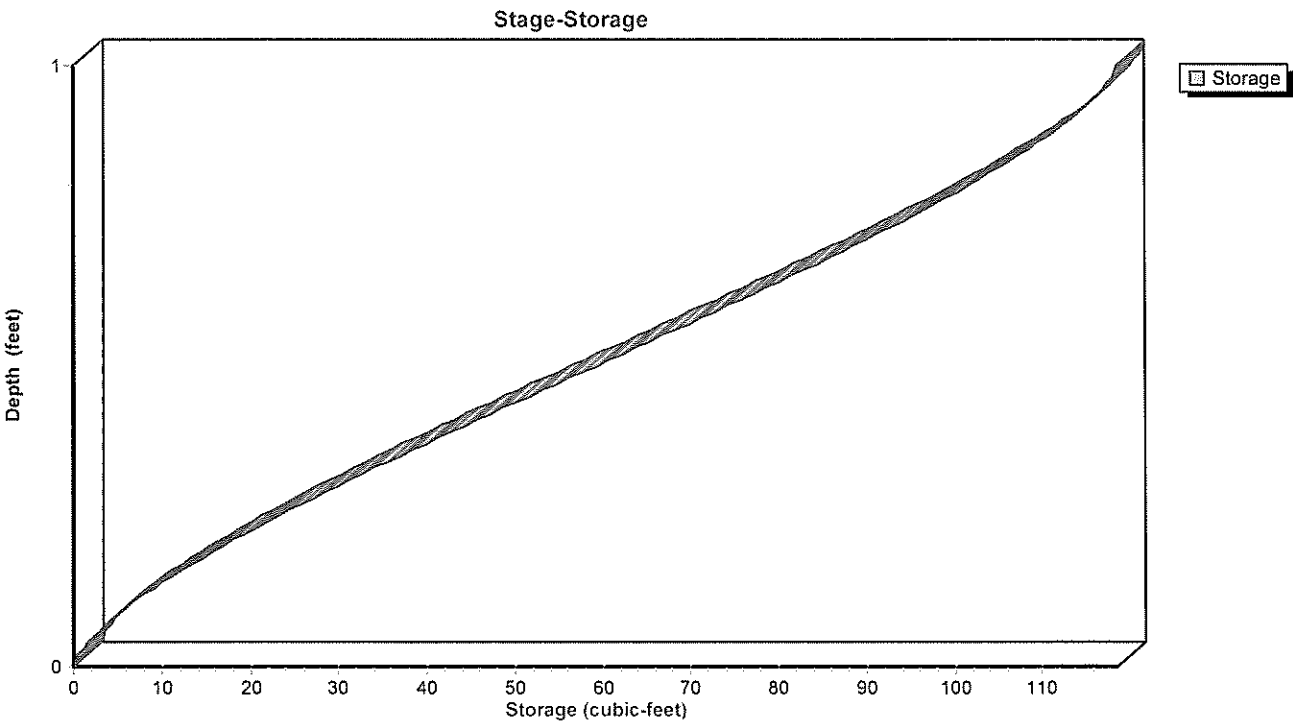
Reach DL: 12" D PVC Drail Line to CB2 in Millbury Street & Municipal Sewer



Reach DL: 12" D PVC Drail Line to CB2 in Millbury Street & Municipal Sewer



Reach DL: 12" D PVC Drail Line to CB2 in Millbury Street & Municipal Sewer



Summary for Pond CB1: Catch Basin 1

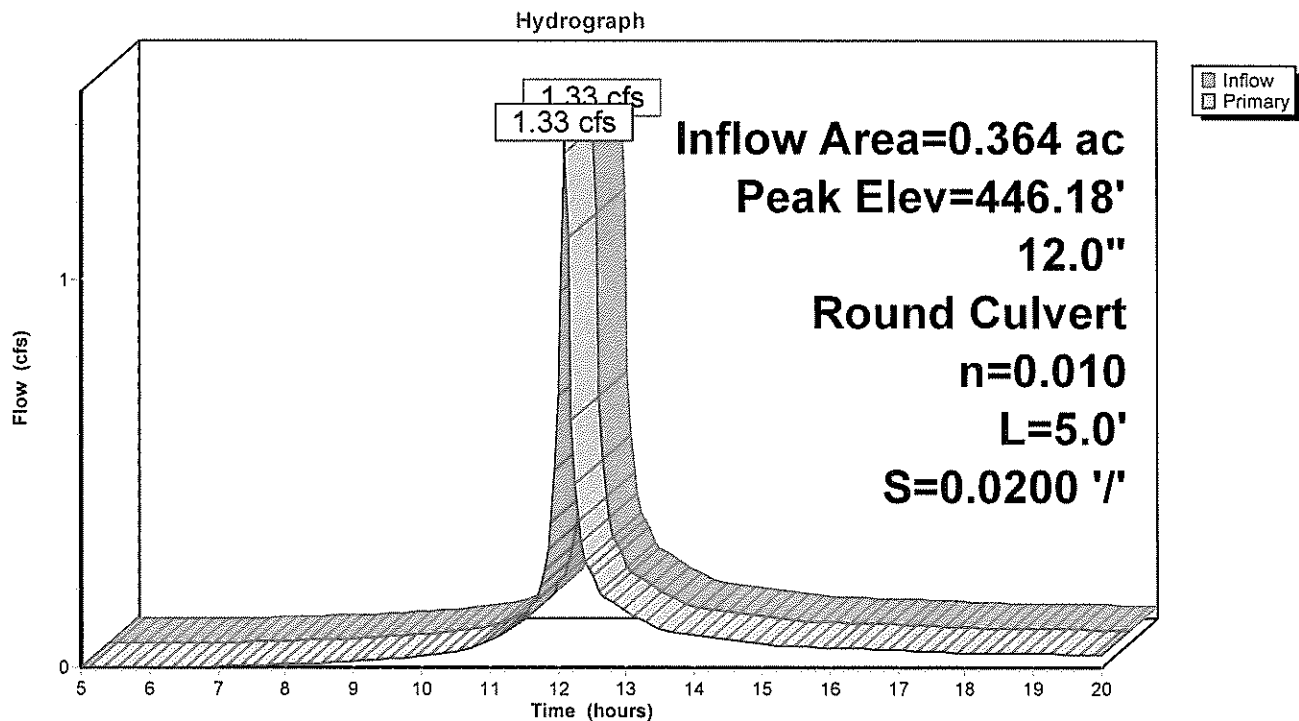
Inflow Area = 0.364 ac, 0.00% Impervious, Inflow Depth > 2.86" for 25-Year event
 Inflow = 1.33 cfs @ 12.11 hrs, Volume= 0.087 af
 Outflow = 1.33 cfs @ 12.11 hrs, Volume= 0.087 af, Atten= 0%, Lag= 0.0 min
 Primary = 1.33 cfs @ 12.11 hrs, Volume= 0.087 af
 Routed to Pond IT : Interceptor?Recharge Trench

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 Peak Elev= 446.18' @ 12.11 hrs

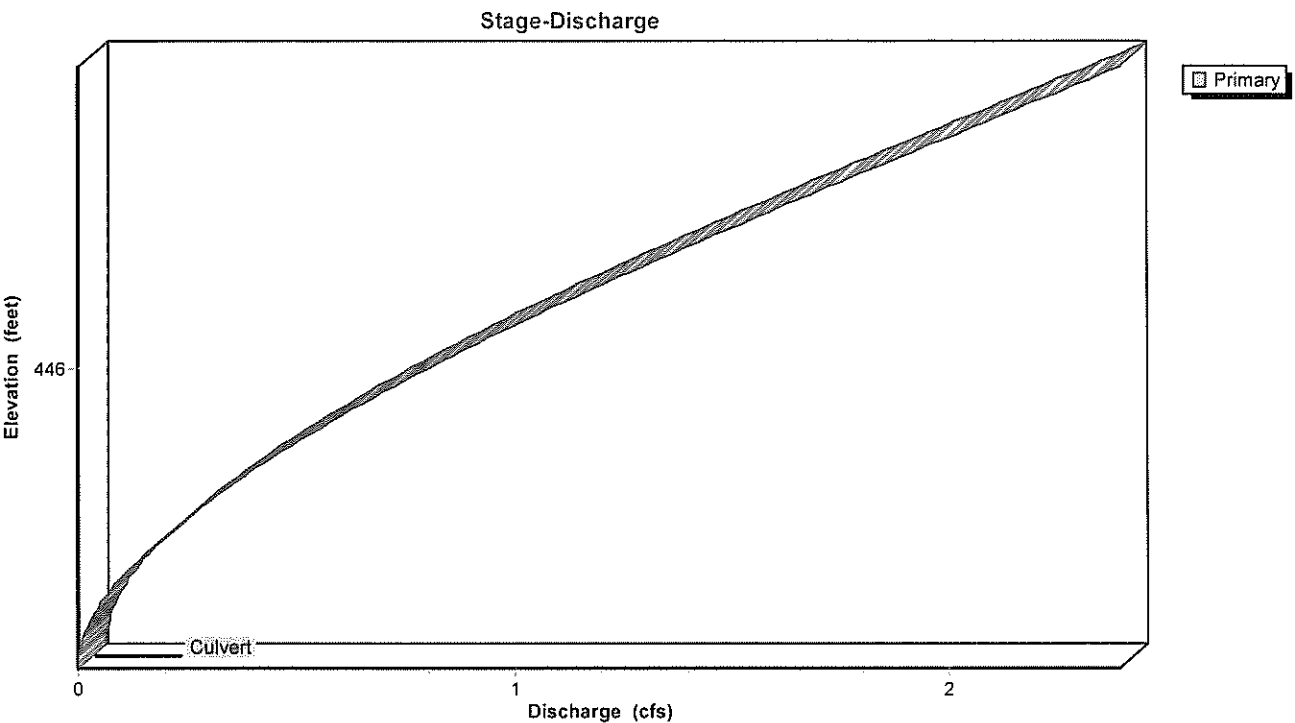
Device	Routing	Invert	Outlet Devices
#1	Primary	445.50'	12.0" Round Culvert L= 5.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 445.50' / 445.40' S= 0.0200 '/ Cc= 0.900 n= 0.010, Flow Area= 0.79 sf

Primary OutFlow Max=1.29 cfs @ 12.11 hrs HW=446.17' (Free Discharge)
 1=Culvert (Barrel Controls 1.29 cfs @ 3.29 fps)

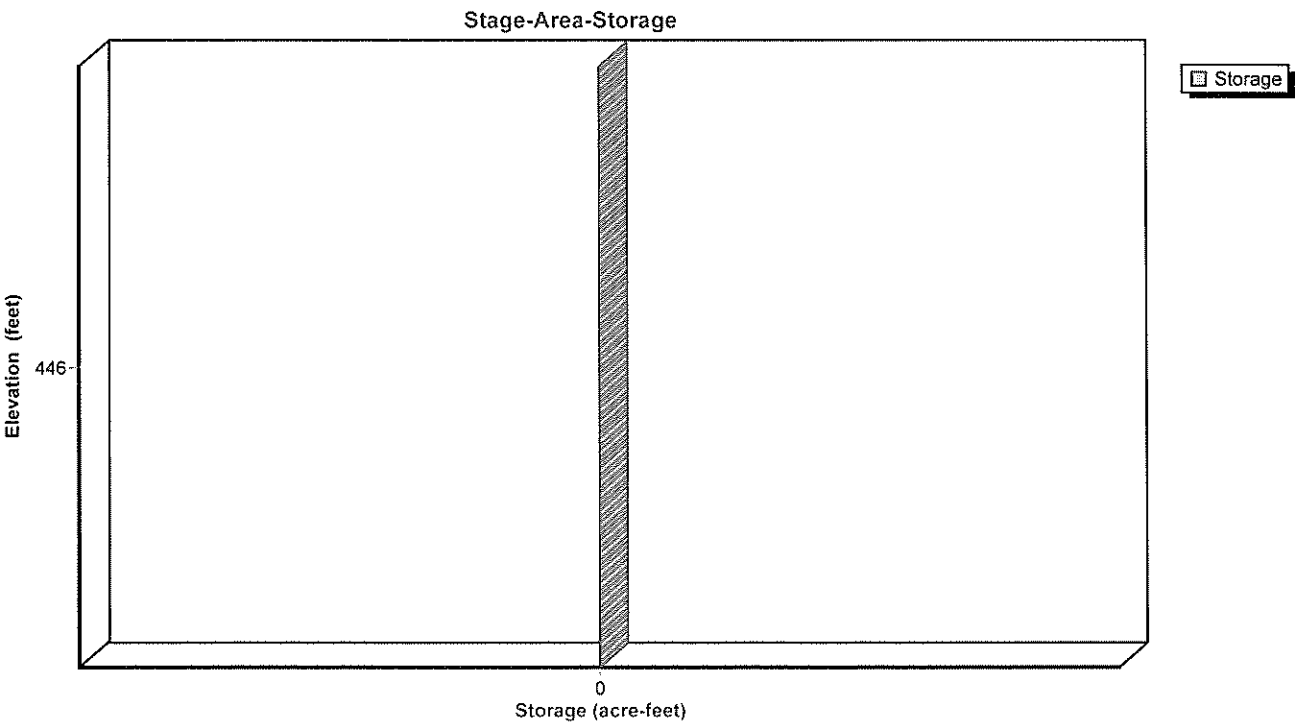
Pond CB1: Catch Basin 1



Pond CB1: Catch Basin 1



Pond CB1: Catch Basin 1



Summary for Pond CB2: Catch Basin

Inflow Area = 0.364 ac, 0.00% Impervious, Inflow Depth > 2.13" for 25-Year event
 Inflow = 1.22 cfs @ 12.13 hrs, Volume= 0.065 af
 Outflow = 1.22 cfs @ 12.13 hrs, Volume= 0.065 af, Atten= 0%, Lag= 0.0 min
 Primary = 1.22 cfs @ 12.13 hrs, Volume= 0.065 af
 Routed to Reach DL : 12" D PVC Drail Line to CB2 in Millbury Street & Municipal Sewer

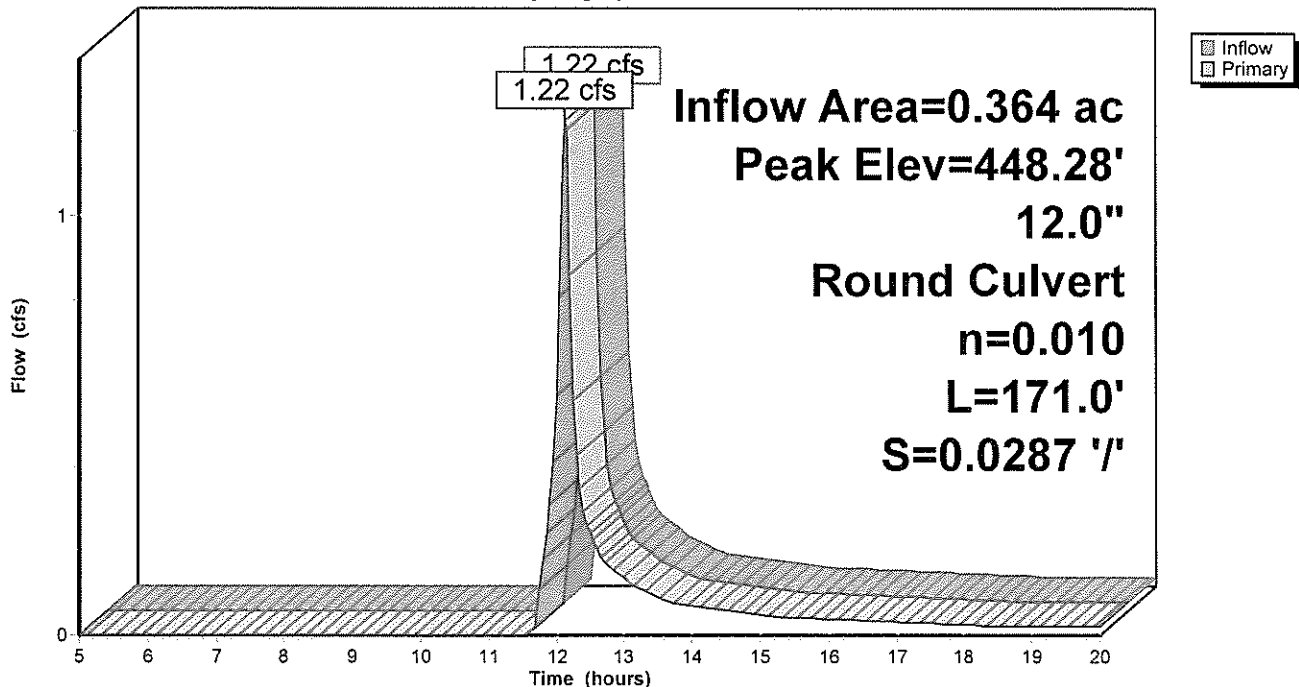
Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 Peak Elev= 448.28' @ 12.13 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	447.70'	12.0" Round Culvert L= 171.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 447.70' / 442.80' S= 0.0287 '/' Cc= 0.900 n= 0.010, Flow Area= 0.79 sf

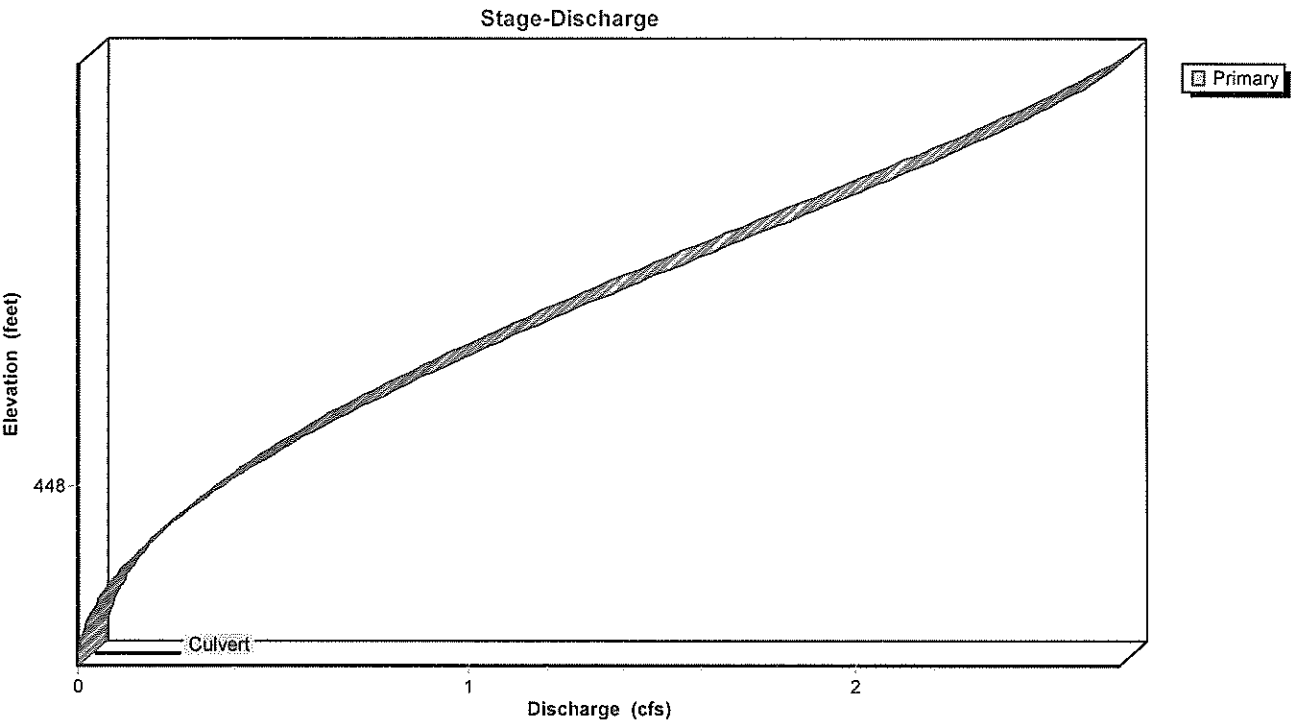
Primary OutFlow Max=1.18 cfs @ 12.13 hrs HW=448.27' (Free Discharge)
 1=Culvert (Inlet Controls 1.18 cfs @ 2.56 fps)

Pond CB2: Catch Basin

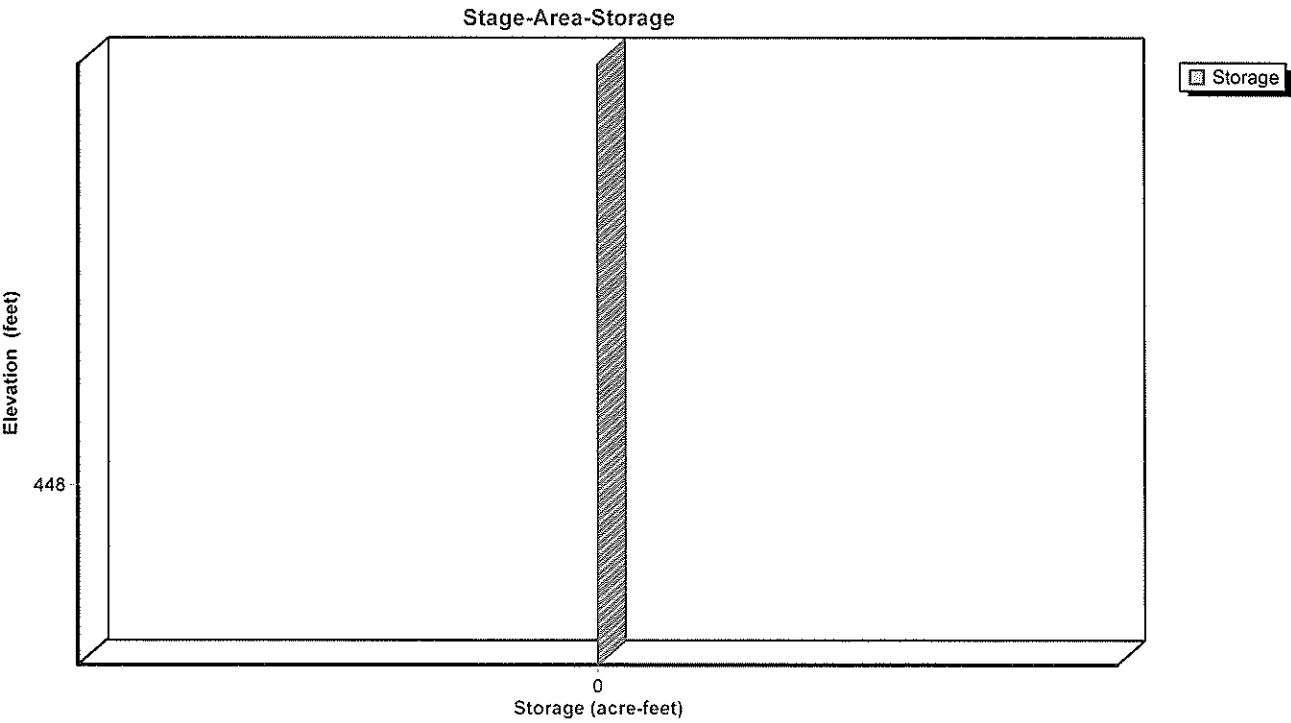
Hydrograph



Pond CB2: Catch Basin



Pond CB2: Catch Basin



Summary for Pond IT: Interceptor?Recharge Trench

Inflow Area = 0.364 ac, 0.00% Impervious, Inflow Depth > 2.86" for 25-Year event
 Inflow = 1.33 cfs @ 12.11 hrs, Volume= 0.087 af
 Outflow = 1.24 cfs @ 12.13 hrs, Volume= 0.078 af, Atten= 7%, Lag= 1.7 min
 Discarded = 0.01 cfs @ 9.10 hrs, Volume= 0.013 af
 Primary = 1.22 cfs @ 12.13 hrs, Volume= 0.065 af
 Routed to Pond CB2 : Catch Basin

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 Peak Elev= 447.19' @ 12.13 hrs Surf.Area= 240 sf Storage= 526 cf

Plug-Flow detention time= 52.3 min calculated for 0.078 af (90% of inflow)
 Center-of-Mass det. time= 17.8 min (814.1 - 796.3)

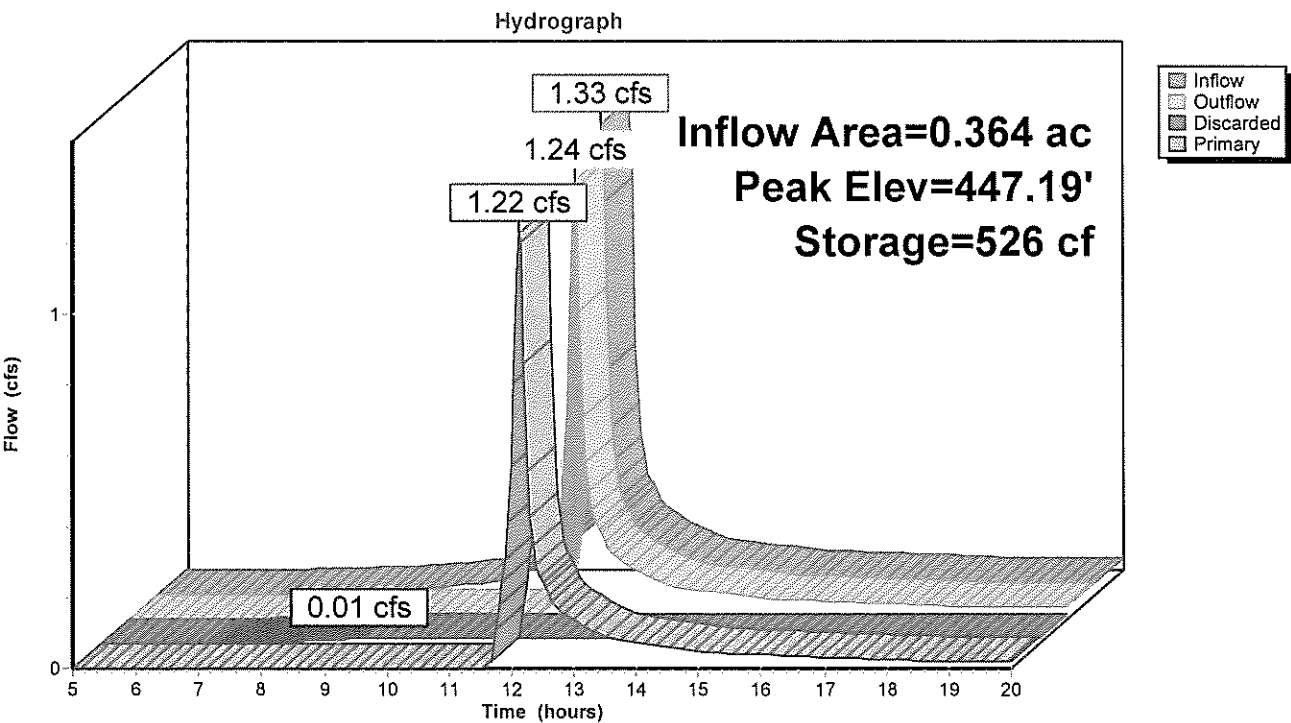
Volume	Invert	Avail.Storage	Storage Description
#1	445.00'	960 cf	3.00'W x 80.00'L x 4.00'H Prismatic

Device	Routing	Invert	Outlet Devices
#1	Discarded	445.00'	2.410 in/hr Exfiltration over Horizontal area
#2	Primary	446.50'	12.0" Round Culvert L= 5.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 446.50' / 446.40' S= 0.0200 '/ Cc= 0.900 n= 0.010, Flow Area= 0.79 sf

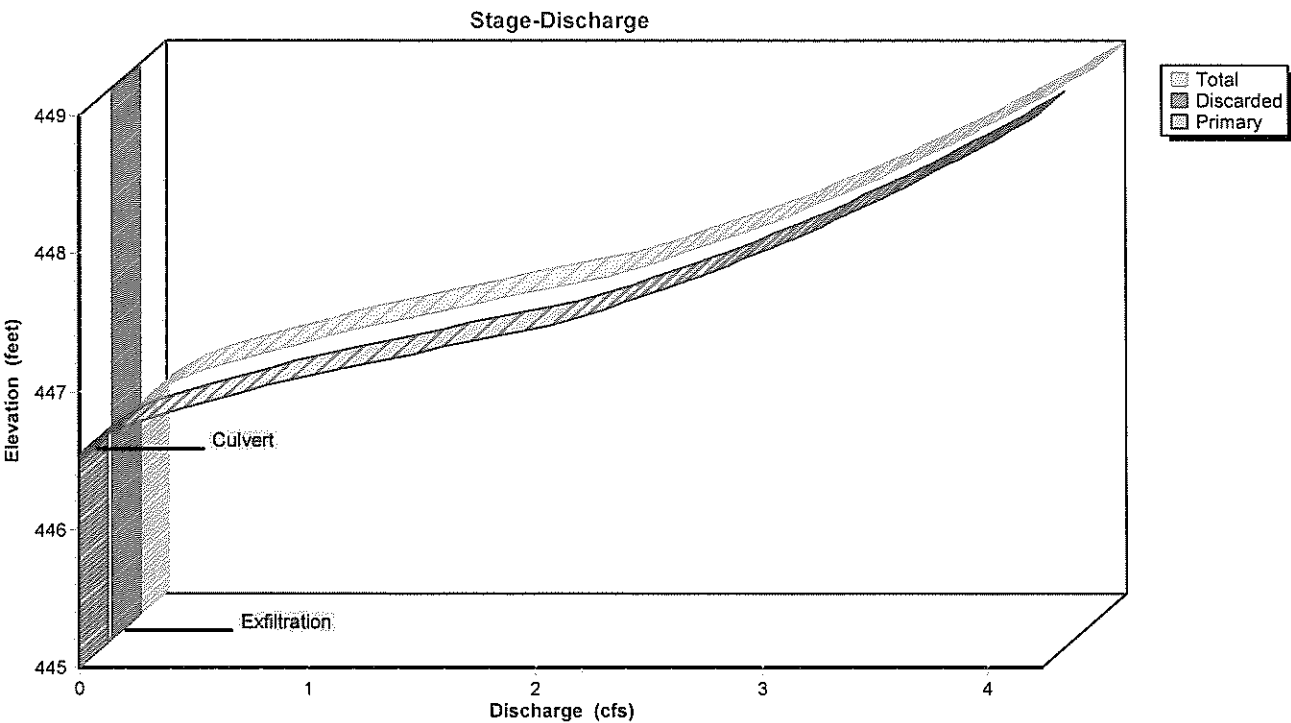
Discarded OutFlow Max=0.01 cfs @ 9.10 hrs HW=445.04' (Free Discharge)
 ↑1=Exfiltration (Exfiltration Controls 0.01 cfs)

Primary OutFlow Max=1.18 cfs @ 12.13 hrs HW=447.18' (Free Discharge)
 ↑2=Culvert (Barrel Controls 1.18 cfs @ 2.95 fps)

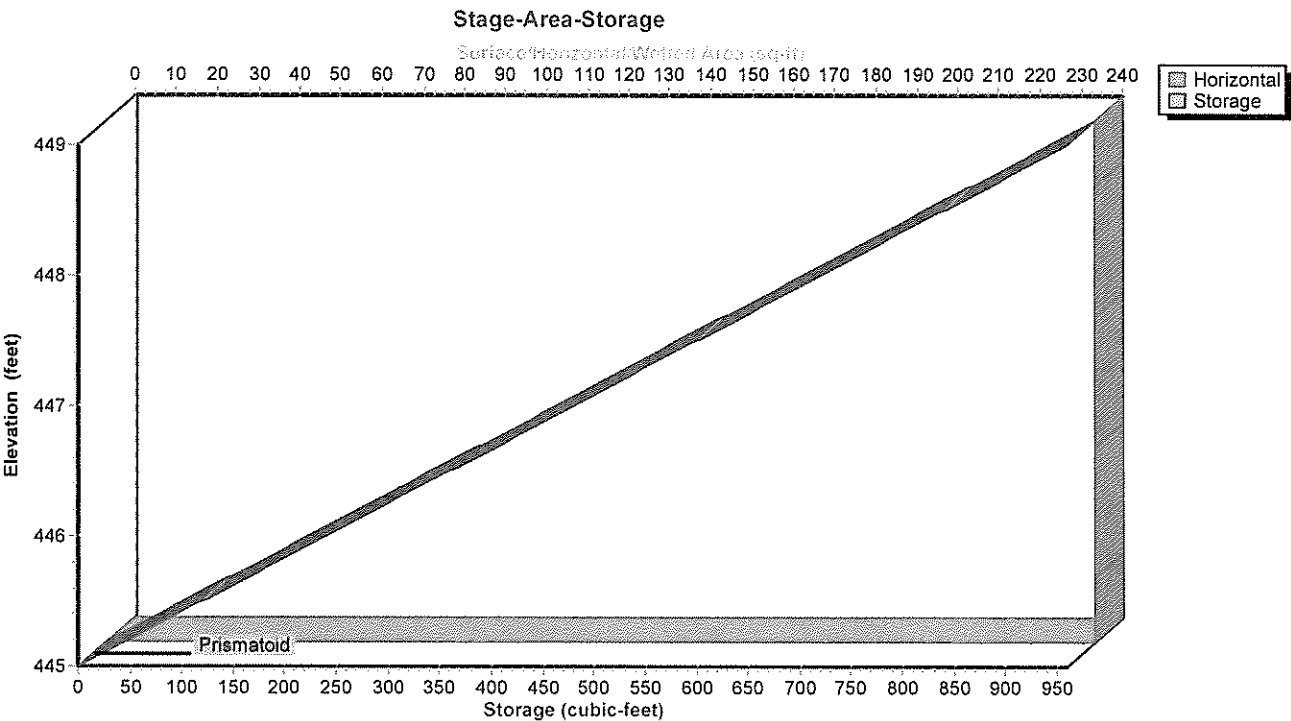
Pond IT: Interceptor?Recharge Trench



Pond IT: Interceptor?Recharge Trench



Pond IT: Interceptor?Recharge Trench

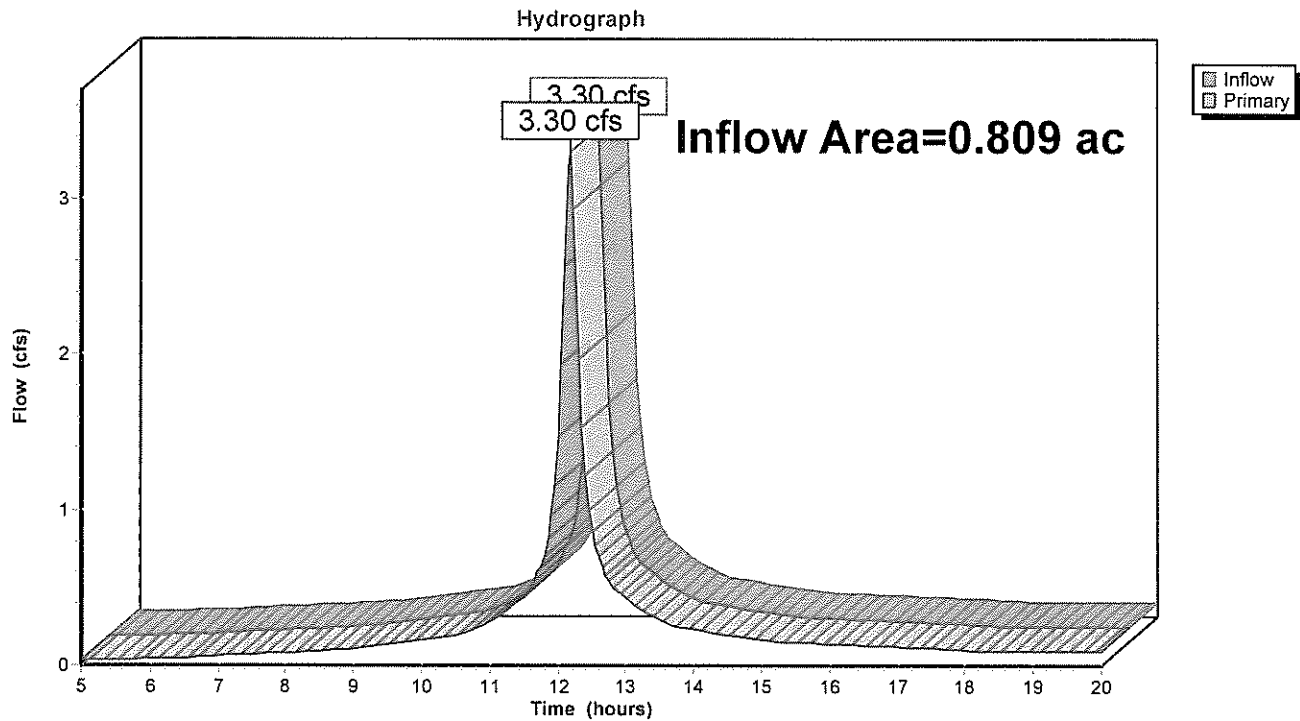


Summary for Link C-M.S.: Design Point - Current Conditions - Millbury Street

Inflow Area = 0.809 ac, 11.27% Impervious, Inflow Depth > 4.30" for 25-Year event
Inflow = 3.30 cfs @ 12.18 hrs, Volume= 0.290 af
Primary = 3.30 cfs @ 12.18 hrs, Volume= 0.290 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link C-M.S.: Design Point - Current Conditions - Millbury Street

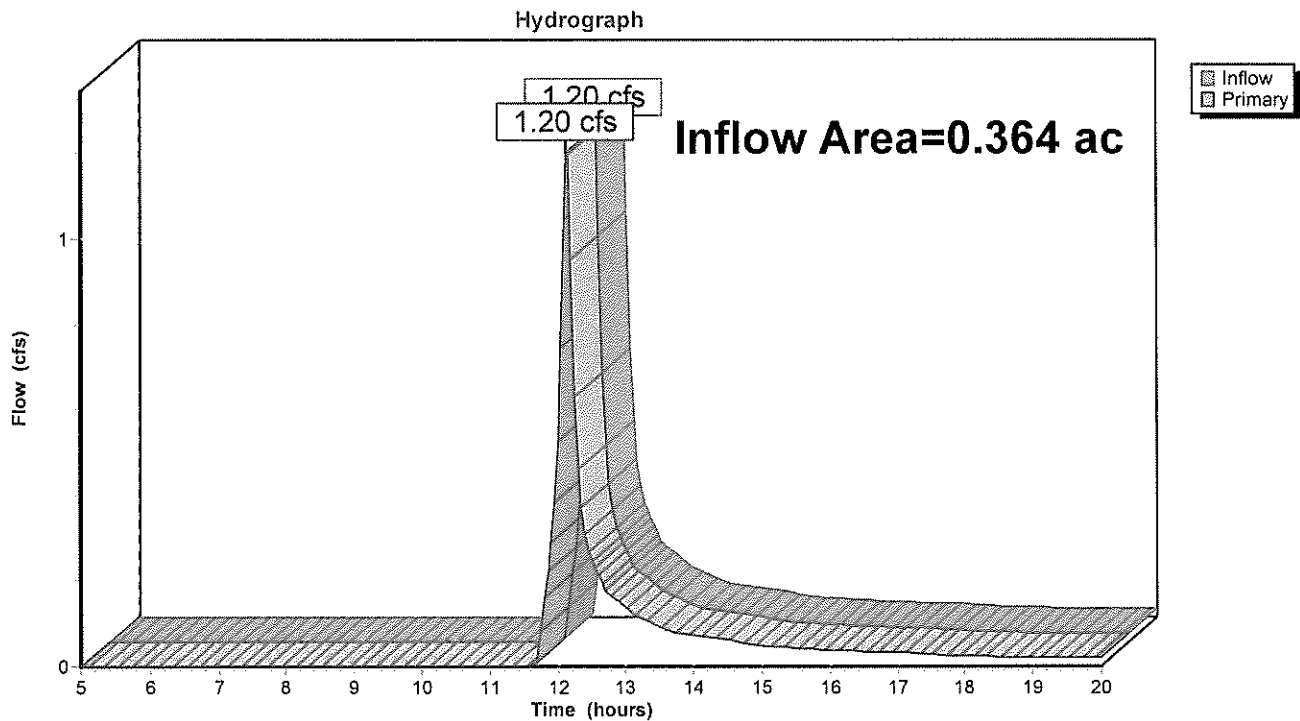


Summary for Link CB3: Design Point - Municipal Catch Basin in Millbury Street

Inflow Area = 0.364 ac, 0.00% Impervious, Inflow Depth > 2.13" for 25-Year event
 Inflow = 1.20 cfs @ 12.14 hrs, Volume= 0.065 af
 Primary = 1.20 cfs @ 12.14 hrs, Volume= 0.065 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link CB3: Design Point - Municipal Catch Basin in Millbury Street

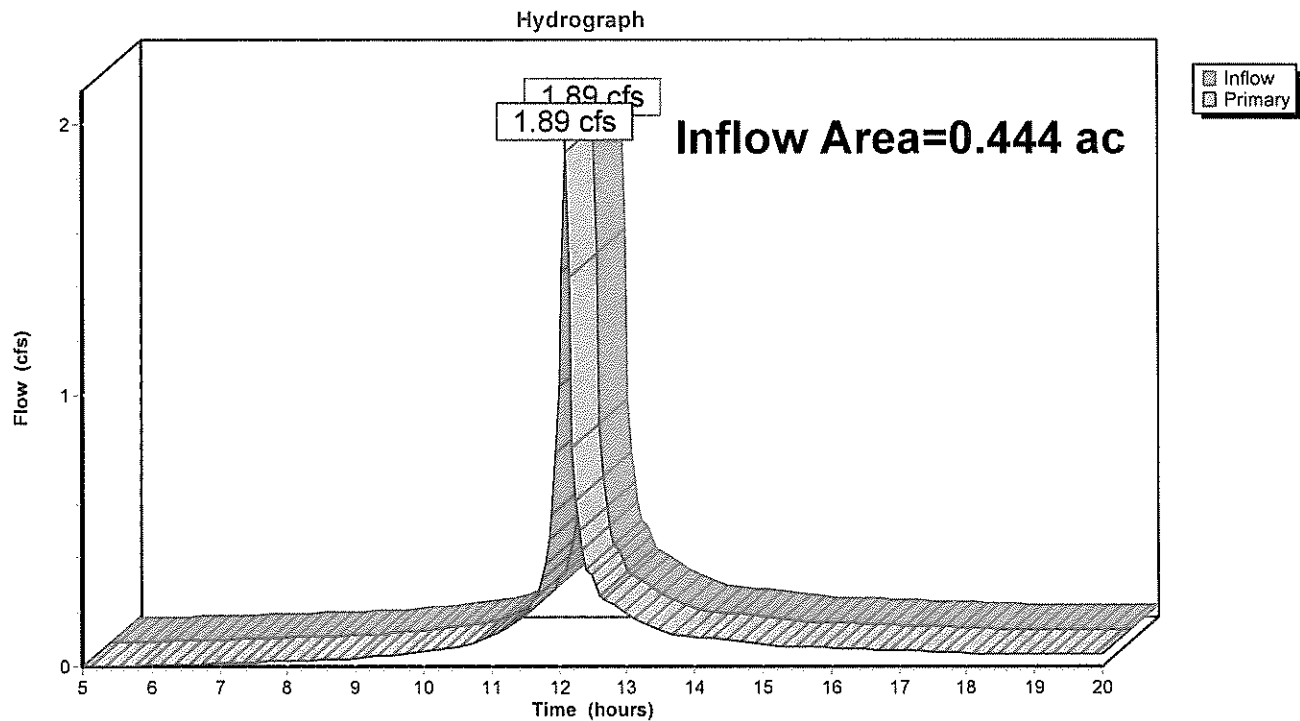


Summary for Link MS: Design Point - Millbury Street

Inflow Area = 0.444 ac, 20.50% Impervious, Inflow Depth > 3.33" for 25-Year event
 Inflow = 1.89 cfs @ 12.10 hrs, Volume= 0.123 af
 Primary = 1.89 cfs @ 12.10 hrs, Volume= 0.123 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link MS: Design Point - Millbury Street



Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
 Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
 Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1089: Current 2020 Runoff Area=35,229 sf 11.27% Impervious Runoff Depth>6.46"
 Flow Length=259' Tc=10.5 min CN=90 Runoff=4.87 cfs 0.436 af

Subcatchment P-A: Poposed 2021 Runoff Area=15,871 sf 0.00% Impervious Runoff Depth>4.86"
 Flow Length=117' Tc=4.3 min CN=75 Runoff=2.20 cfs 0.148 af

Subcatchment P-B: Poposed 2021 Runoff Area=19,358 sf 20.50% Impervious Runoff Depth>5.42"
 Flow Length=139' Tc=3.8 min CN=80 Runoff=3.00 cfs 0.201 af

Reach DL: 12" D PVC Drail Line to CB2 Avg. Flow Depth=0.41' Max Vel=6.86 fps Inflow=2.05 cfs 0.123 af
 12.0" Round Pipe n=0.010 L=151.0' S=0.0166 '/' Capacity=5.96 cfs Outflow=2.02 cfs 0.123 af

Pond CB1: Catch Basin 1 Peak Elev=446.44' Inflow=2.20 cfs 0.148 af
 12.0" Round Culvert n=0.010 L=5.0' S=0.0200 '/' Outflow=2.20 cfs 0.148 af

Pond CB2: Catch Basin Peak Elev=448.50' Inflow=2.05 cfs 0.123 af
 12.0" Round Culvert n=0.010 L=171.0' S=0.0287 '/' Outflow=2.05 cfs 0.123 af

Pond IT: Interceptor?RechargeTrench Peak Elev=447.47' Storage=593 cf Inflow=2.20 cfs 0.148 af
 Discarded=0.01 cfs 0.015 af Primary=2.05 cfs 0.123 af Outflow=2.07 cfs 0.139 af

Link C-M.S.: Design Point - Current Conditions - Millbury Street Inflow=4.87 cfs 0.436 af
 Primary=4.87 cfs 0.436 af

Link CB3: Design Point - Municipal Catch Basin in Millbury Street Inflow=2.02 cfs 0.123 af
 Primary=2.02 cfs 0.123 af

Link MS: Design Point - Millbury Street Inflow=3.00 cfs 0.201 af
 Primary=3.00 cfs 0.201 af

Total Runoff Area = 1.617 ac Runoff Volume = 0.784 af Average Runoff Depth = 5.82"
88.73% Pervious = 1.435 ac 11.27% Impervious = 0.182 ac

Summary for Subcatchment 1089: Current 2020 Conditions 1087-1089 Millbury St.TOTAL LOT

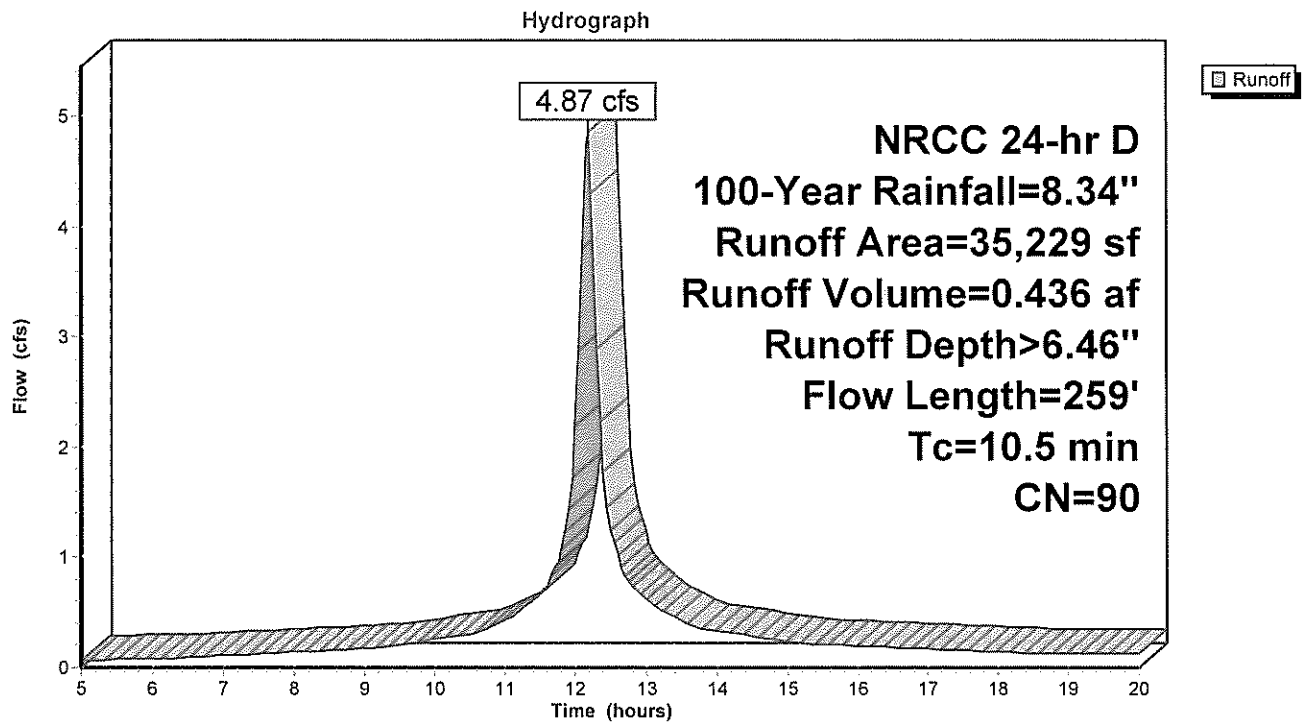
Runoff = 4.87 cfs @ 12.18 hrs, Volume= 0.436 af, Depth> 6.46"
 Routed to Link C-M.S. : Design Point - Current Conditions - Millbury Street

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 NRCC 24-hr D 100-Year Rainfall=8.34"

Area (sf)	CN	Description
1,900	70	Woods, Good, HSG C
820	74	>75% Grass cover, Good, HSG C
* 1,824	98	House Roofs
* 2,145	98	Pavement
* 2,200	83	Boulders
26,340	91	Fallow, bare soil, HSG C
35,229	90	Weighted Average
31,260		88.73% Pervious Area
3,969		11.27% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.8	32	0.0600	0.05		Sheet Flow, Sheet Flow
					Woods: Dense underbrush n= 0.800 P2= 3.13"
0.1	73	0.4500	10.80		Shallow Concentrated Flow, Shallow Concentrated
					Unpaved Kv= 16.1 fps
0.6	154	0.0840	4.67		Shallow Concentrated Flow, Shallo Concentrated
					Unpaved Kv= 16.1 fps
10.5	259	Total			

Subcatchment 1089: Current 2020 Conditions 1087-1089 Millbury St.TOTAL LOT



ary for Subcatchment P-A: Poposed 2021 Conditions 1087-1089 Millbury St. Upper Section to Dra

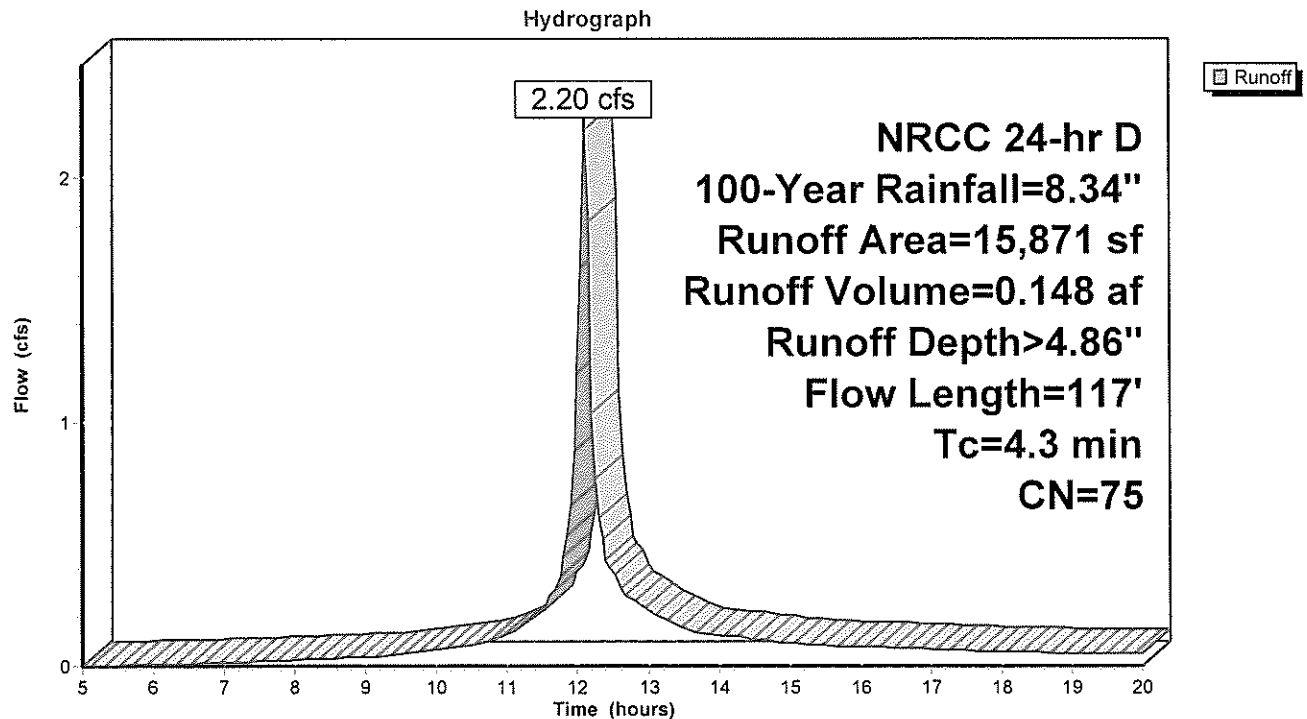
Runoff = 2.20 cfs @ 12.10 hrs, Volume= 0.148 af, Depth> 4.86"
 Routed to Pond CB1 : Catch Basin 1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 NRCC 24-hr D 100-Year Rainfall=8.34"

Area (sf)	CN	Description
1,913	70	Woods, Good, HSG C
11,343	74	>75% Grass cover, Good, HSG C
* 2,615	83	Boulders
15,871	75	Weighted Average
15,871		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.4	10	0.2000	0.07		Sheet Flow, Sheet Flow-1 Trees Woods: Dense underbrush n= 0.800 P2= 3.13"
1.6	40	0.3000	0.41		Sheet Flow, Sheet Flow 2 - Grass Grass: Short n= 0.150 P2= 3.13"
0.3	67	0.3000	3.83		Shallow Concentrated Flow, Shallow Concentrated Short Grass Pasture Kv= 7.0 fps
4.3	117	Total			

Subcatchment P-A: Poposed 2021 Conditions 1087-1089 Millbury St. Upper Section to Drain Syst



Hydrograph for Subcatchment P-B: Poposed 2021 Conditions 1087-1089 Millbury St. Lower Section To Millbury St.

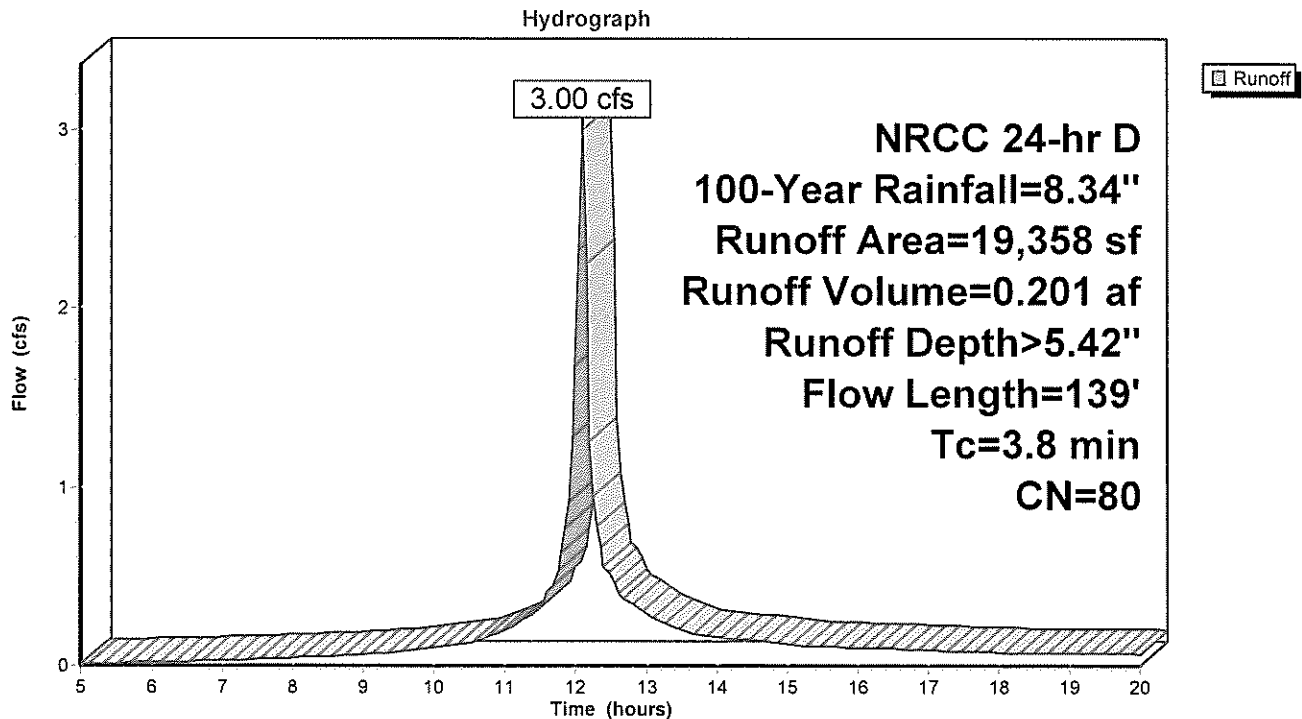
Runoff = 3.00 cfs @ 12.10 hrs, Volume= 0.201 af, Depth> 5.42"
 Routed to Link MS : Design Point - Millbury Street

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 NRCC 24-hr D 100-Year Rainfall=8.34"

Area (sf)	CN	Description
14,010	74	>75% Grass cover, Good, HSG C
* 1,824	98	House Roofs
* 2,145	98	Pavement
* 1,379	83	Boulders
19,358	80	Weighted Average
15,389		79.50% Pervious Area
3,969		20.50% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.0	50	0.1000	0.28		Sheet Flow, Sheet Flow - Grass
					Grass: Short n= 0.150 P2= 3.13"
0.8	89	0.0700	1.85		Shallow Concentrated Flow, Shallow Concentrated
					Short Grass Pasture Kv= 7.0 fps
3.8	139	Total			

Hydrograph for Subcatchment P-B: Poposed 2021 Conditions 1087-1089 Millbury St. Lower Section To Millbury St.



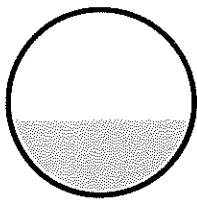
Summary for Reach DL: 12" D PVC Drail Line to CB2 in Millbury Street & Municipal Sewer

Inflow Area = 0.364 ac, 0.00% Impervious, Inflow Depth > 4.06" for 100-Year event
 Inflow = 2.05 cfs @ 12.13 hrs, Volume= 0.123 af
 Outflow = 2.02 cfs @ 12.14 hrs, Volume= 0.123 af, Atten= 2%, Lag= 0.6 min
 Routed to Link CB3 : Design Point - Municipal Catch Basin in Millbury Street

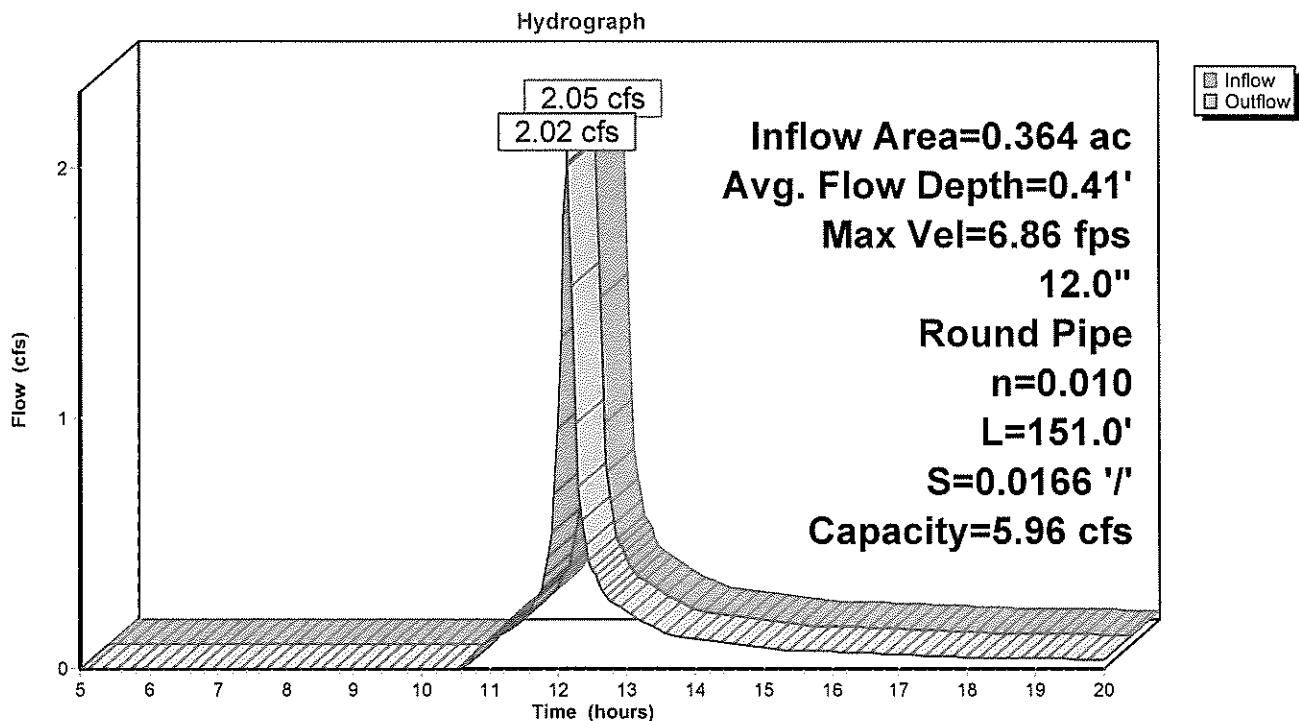
Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 Max. Velocity= 6.86 fps, Min. Travel Time= 0.4 min
 Avg. Velocity = 2.89 fps, Avg. Travel Time= 0.9 min

Peak Storage= 45 cf @ 12.14 hrs
 Average Depth at Peak Storage= 0.41' , Surface Width= 0.98'
 Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 5.96 cfs

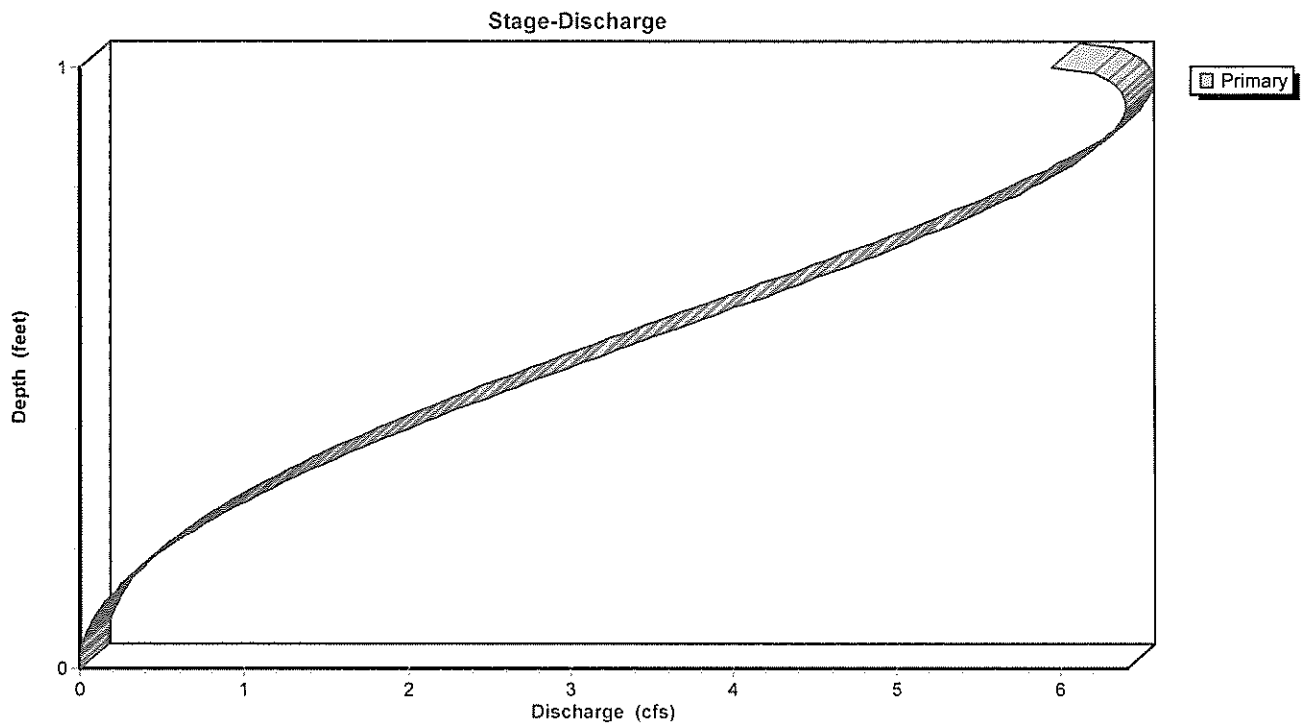
12.0" Round Pipe
 n= 0.010
 Length= 151.0' Slope= 0.0166 '/
 Inlet Invert= 444.70', Outlet Invert= 442.20'



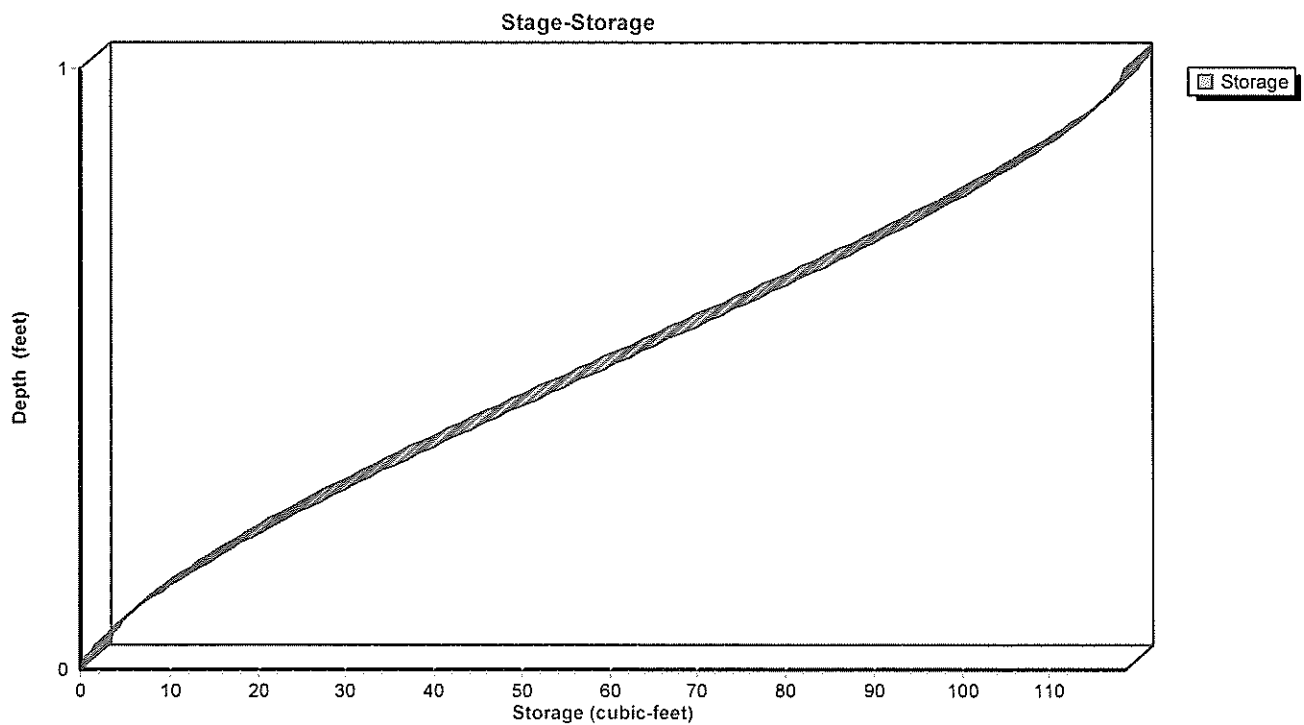
Reach DL: 12" D PVC Drail Line to CB2 in Millbury Street & Municipal Sewer



Reach DL: 12" D PVC Drail Line to CB2 in Millbury Street & Municipal Sewer



Reach DL: 12" D PVC Drail Line to CB2 in Millbury Street & Municipal Sewer



Summary for Pond CB1: Catch Basin 1

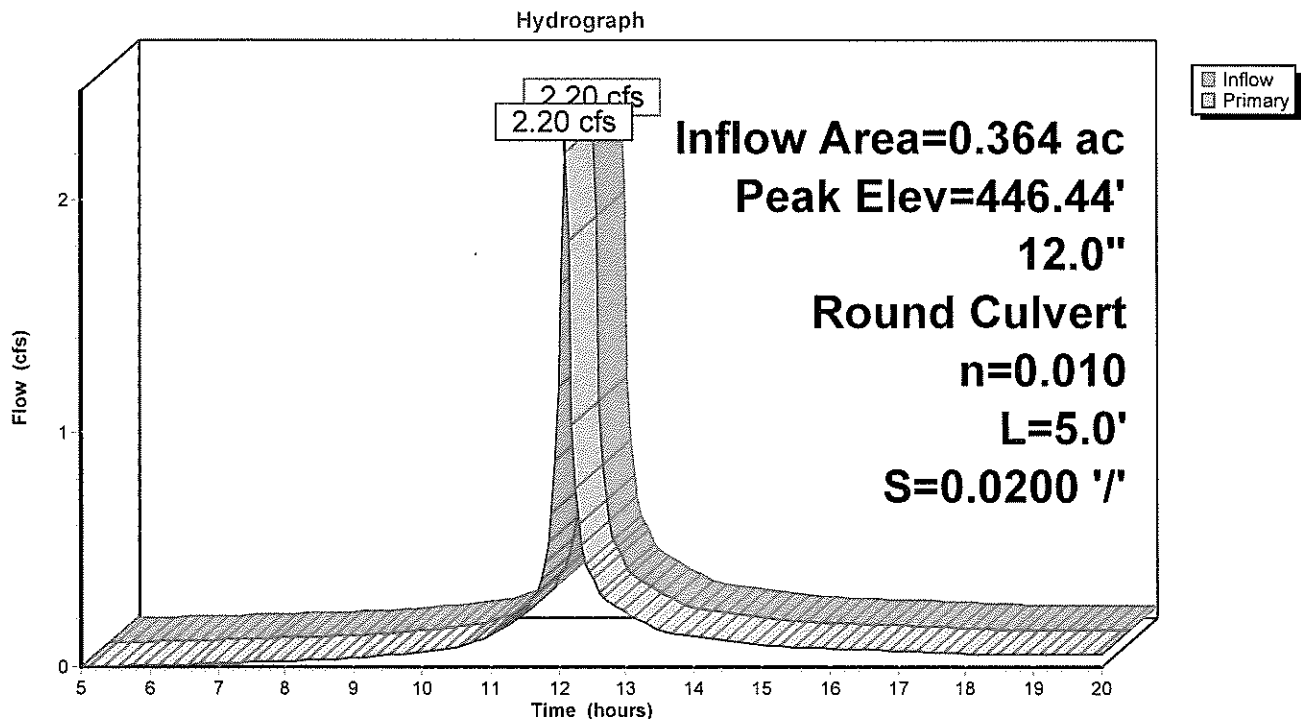
Inflow Area = 0.364 ac, 0.00% Impervious, Inflow Depth > 4.86" for 100-Year event
 Inflow = 2.20 cfs @ 12.10 hrs, Volume= 0.148 af
 Outflow = 2.20 cfs @ 12.10 hrs, Volume= 0.148 af, Atten= 0%, Lag= 0.0 min
 Primary = 2.20 cfs @ 12.10 hrs, Volume= 0.148 af
 Routed to Pond IT : Interceptor?Recharge Trench

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 Peak Elev= 446.44' @ 12.10 hrs

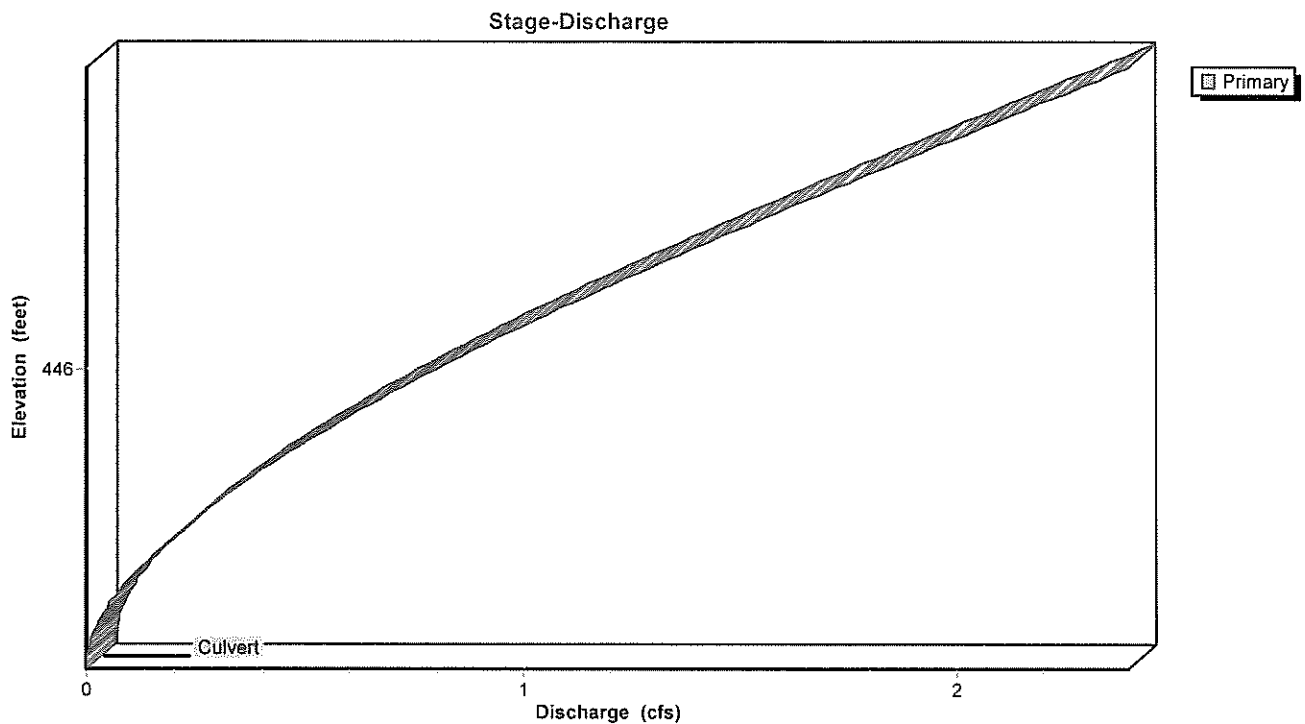
Device	Routing	Invert	Outlet Devices
#1	Primary	445.50'	12.0" Round Culvert L= 5.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 445.50' / 445.40' S= 0.0200 '/ Cc= 0.900 n= 0.010, Flow Area= 0.79 sf

Primary OutFlow Max=2.16 cfs @ 12.10 hrs HW=446.43' (Free Discharge)
 1=Culvert (Barrel Controls 2.16 cfs @ 3.69 fps)

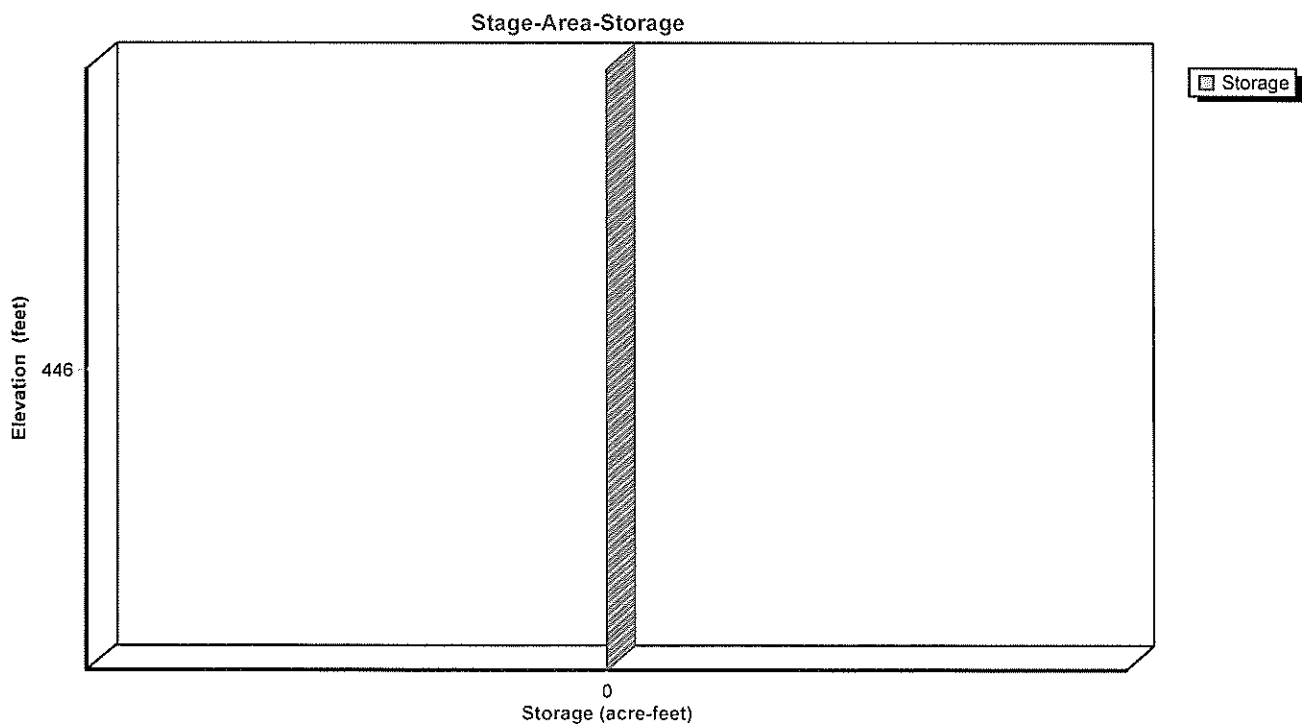
Pond CB1: Catch Basin 1



Pond CB1: Catch Basin 1



Pond CB1: Catch Basin 1



Summary for Pond CB2: Catch Basin

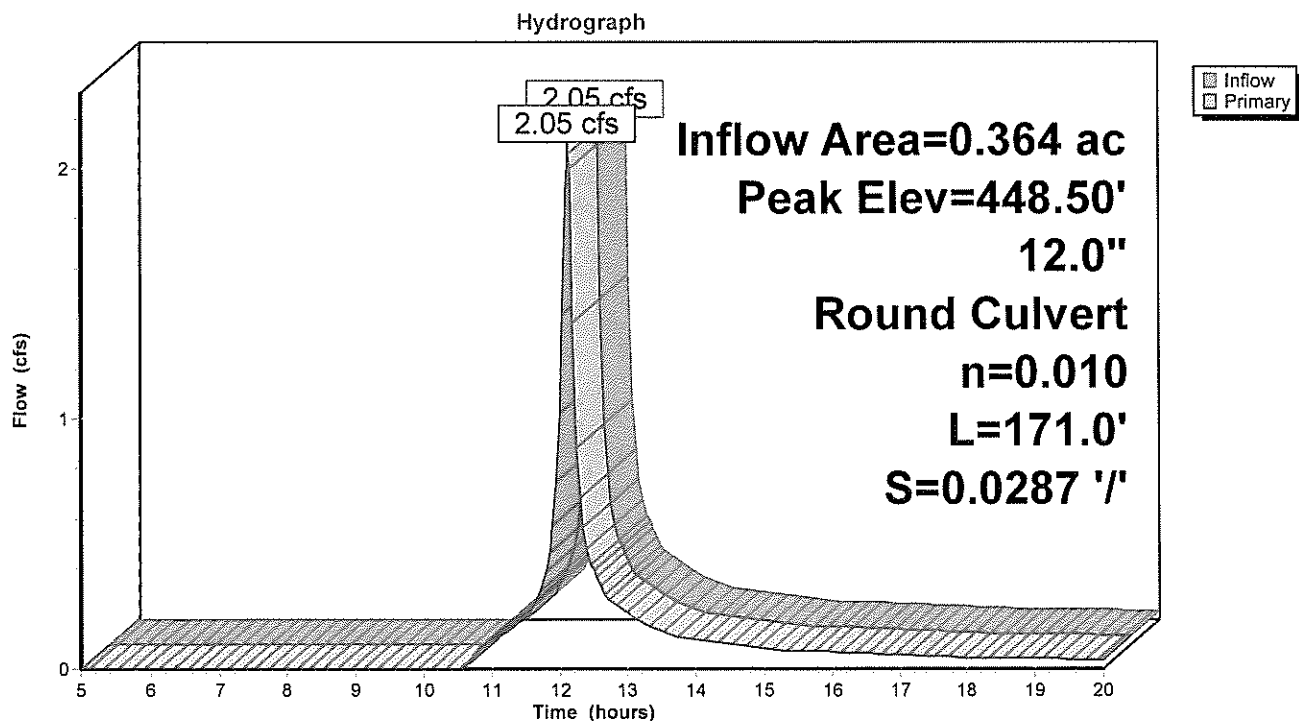
Inflow Area = 0.364 ac, 0.00% Impervious, Inflow Depth > 4.06" for 100-Year event
 Inflow = 2.05 cfs @ 12.13 hrs, Volume= 0.123 af
 Outflow = 2.05 cfs @ 12.13 hrs, Volume= 0.123 af, Atten= 0%, Lag= 0.0 min
 Primary = 2.05 cfs @ 12.13 hrs, Volume= 0.123 af
 Routed to Reach DL : 12" D PVC Drail Line to CB2 in Millbury Street & Municipal Sewer

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 Peak Elev= 448.50' @ 12.13 hrs

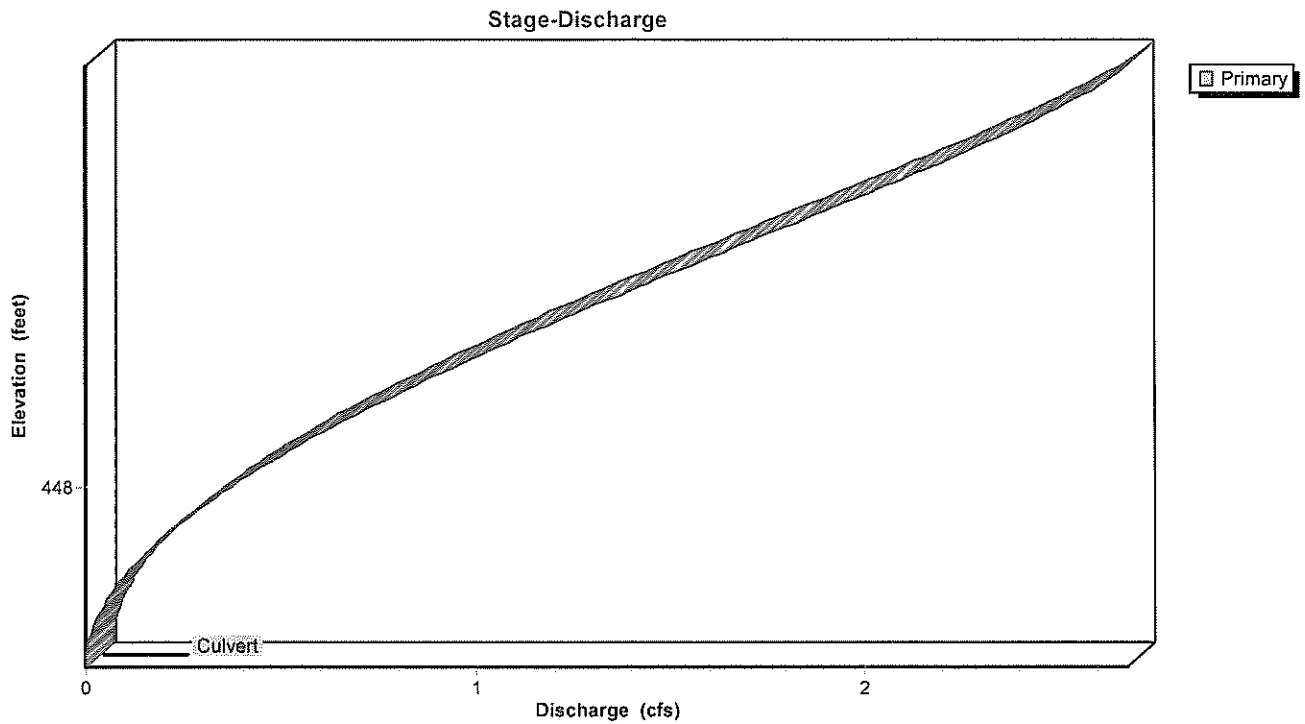
Device	Routing	Invert	Outlet Devices
#1	Primary	447.70'	12.0" Round Culvert L= 171.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 447.70' / 442.80' S= 0.0287 '/ Cc= 0.900 n= 0.010, Flow Area= 0.79 sf

Primary OutFlow Max=1.97 cfs @ 12.13 hrs HW=448.48' (Free Discharge)
 1=Culvert (Inlet Controls 1.97 cfs @ 3.00 fps)

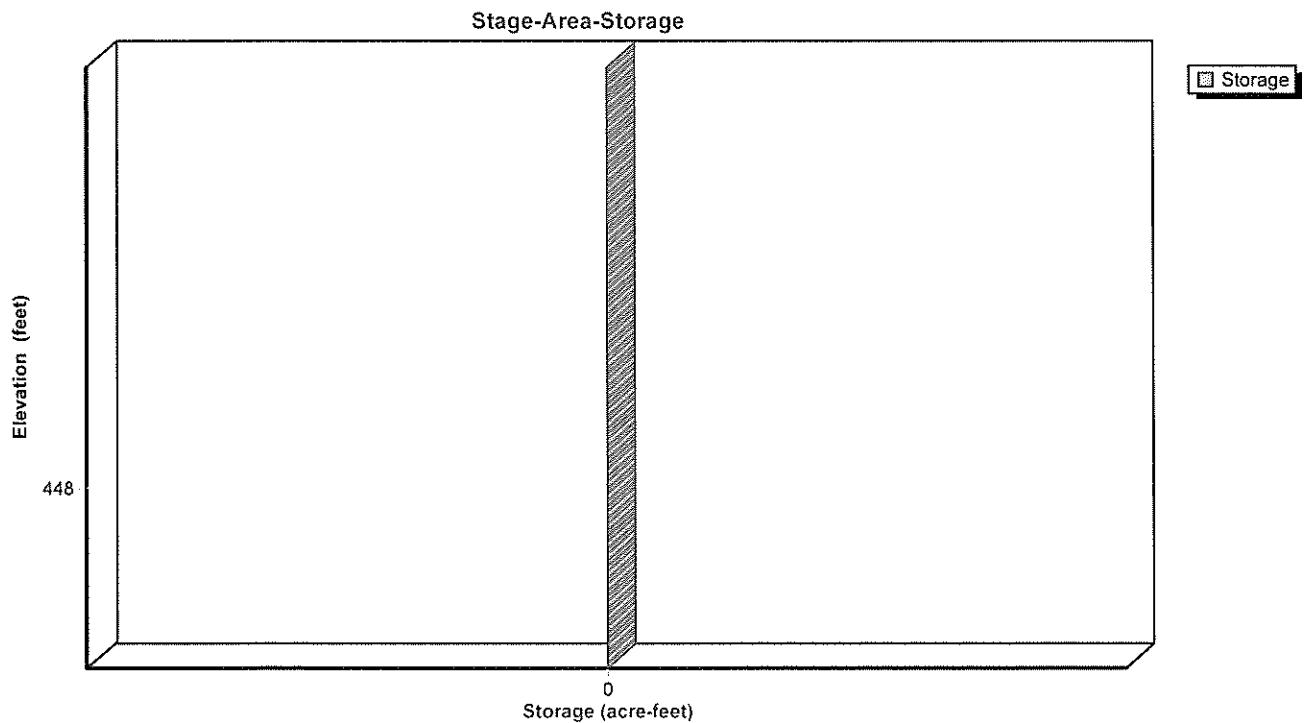
Pond CB2: Catch Basin



Pond CB2: Catch Basin



Pond CB2: Catch Basin



Summary for Pond IT: Interceptor?Recharge Trench

Inflow Area = 0.364 ac, 0.00% Impervious, Inflow Depth > 4.86" for 100-Year event
 Inflow = 2.20 cfs @ 12.10 hrs, Volume= 0.148 af
 Outflow = 2.07 cfs @ 12.13 hrs, Volume= 0.139 af, Atten= 6%, Lag= 1.5 min
 Discarded = 0.01 cfs @ 7.15 hrs, Volume= 0.015 af
 Primary = 2.05 cfs @ 12.13 hrs, Volume= 0.123 af
 Routed to Pond CB2 : Catch Basin

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 Peak Elev= 447.47' @ 12.13 hrs Surf.Area= 240 sf Storage= 593 cf

Plug-Flow detention time= 38.0 min calculated for 0.139 af (94% of inflow)
 Center-of-Mass det. time= 15.1 min (795.7 - 780.5)

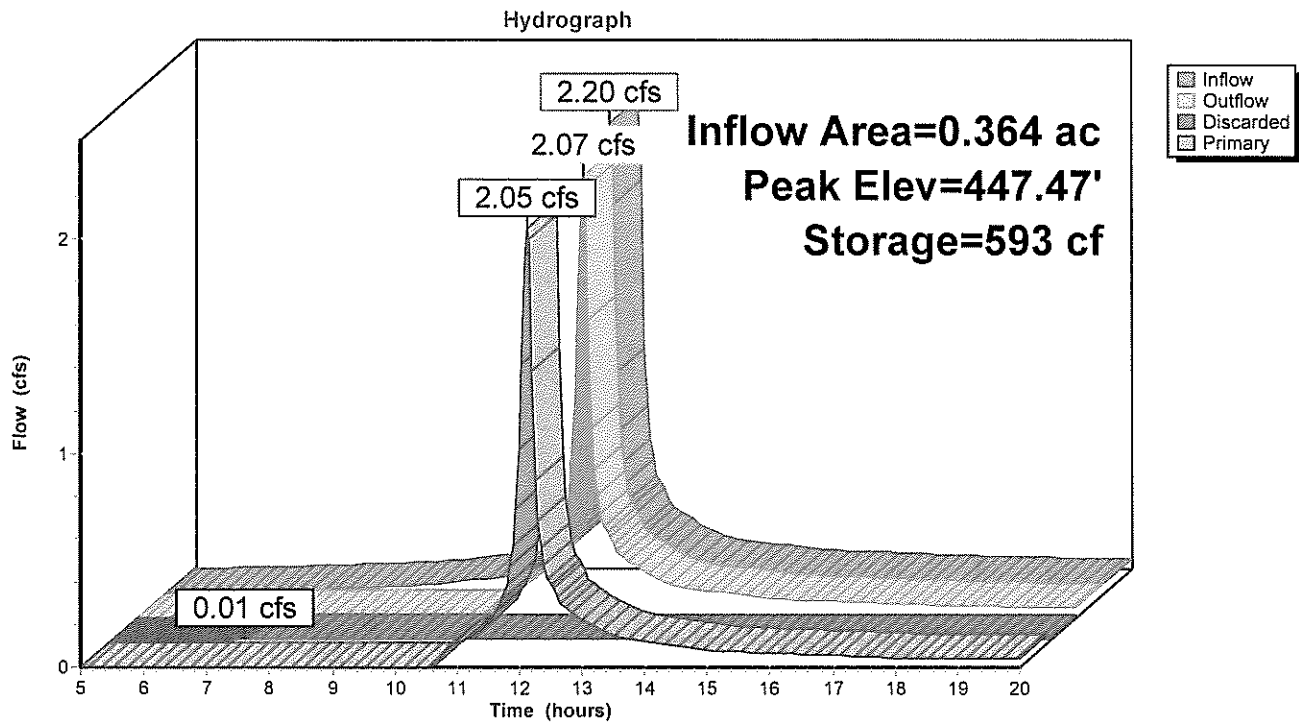
Volume	Invert	Avail.Storage	Storage Description
#1	445.00'	960 cf	3.00'W x 80.00'L x 4.00'H Prismatic

Device	Routing	Invert	Outlet Devices
#1	Discarded	445.00'	2.410 in/hr Exfiltration over Horizontal area
#2	Primary	446.50'	12.0" Round Culvert L= 5.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 446.50' / 446.40' S= 0.0200 '/ Cc= 0.900 n= 0.010, Flow Area= 0.79 sf

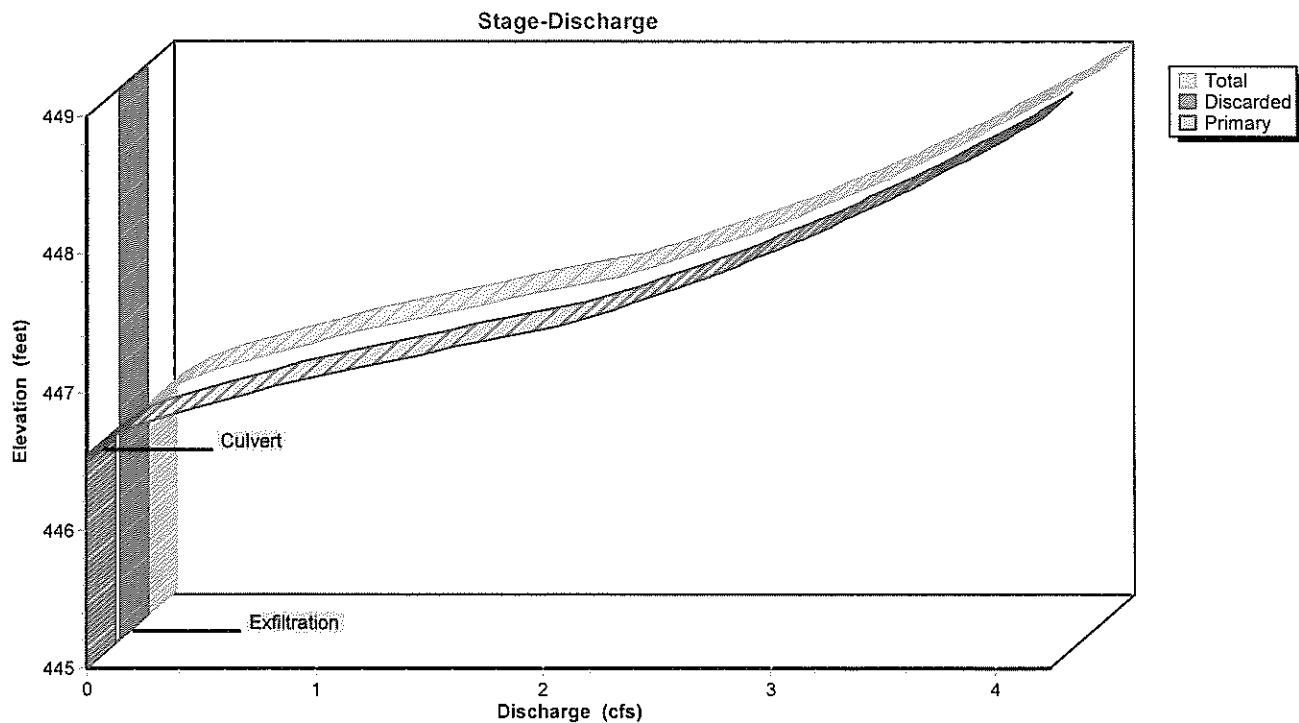
Discarded OutFlow Max=0.01 cfs @ 7.15 hrs HW=445.04' (Free Discharge)
 1=Exfiltration (Exfiltration Controls 0.01 cfs)

Primary OutFlow Max=1.97 cfs @ 12.13 hrs HW=447.44' (Free Discharge)
 2=Culvert (Barrel Controls 1.97 cfs @ 3.31 fps)

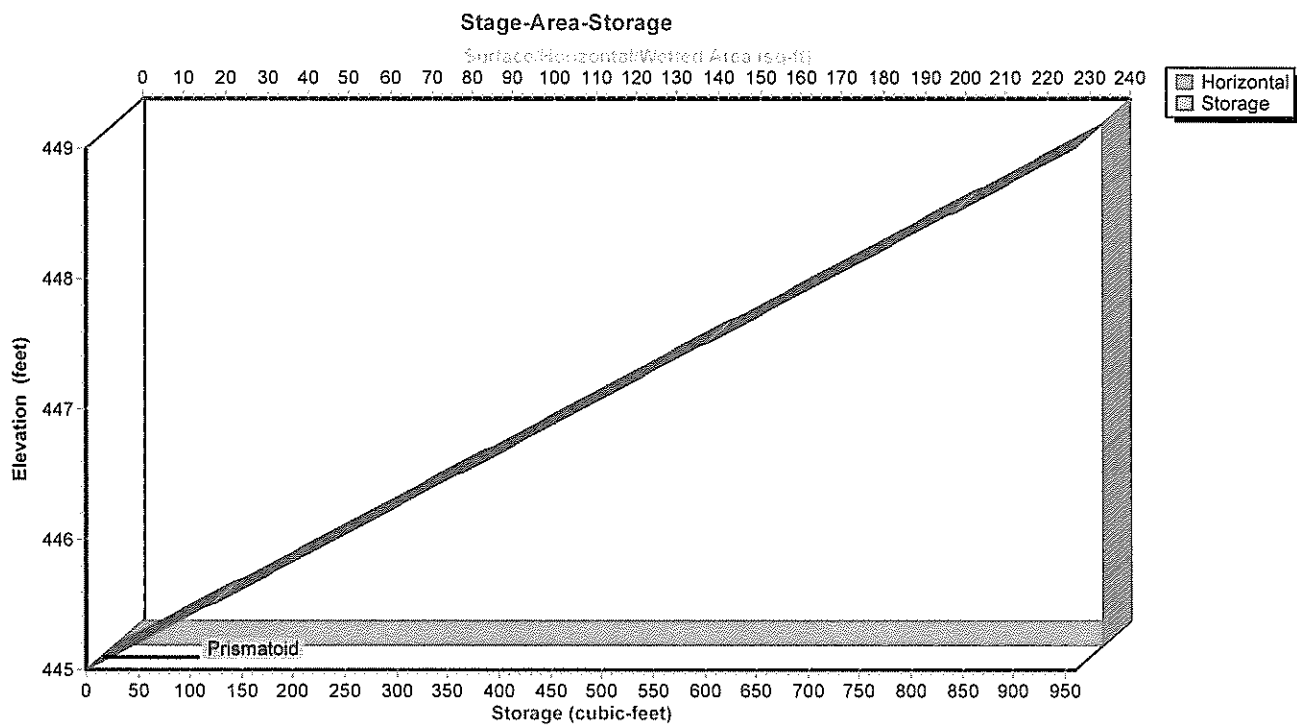
Pond IT: Interceptor?Recharge Trench



Pond IT: Interceptor?Recharge Trench



Pond IT: Interceptor?Recharge Trench

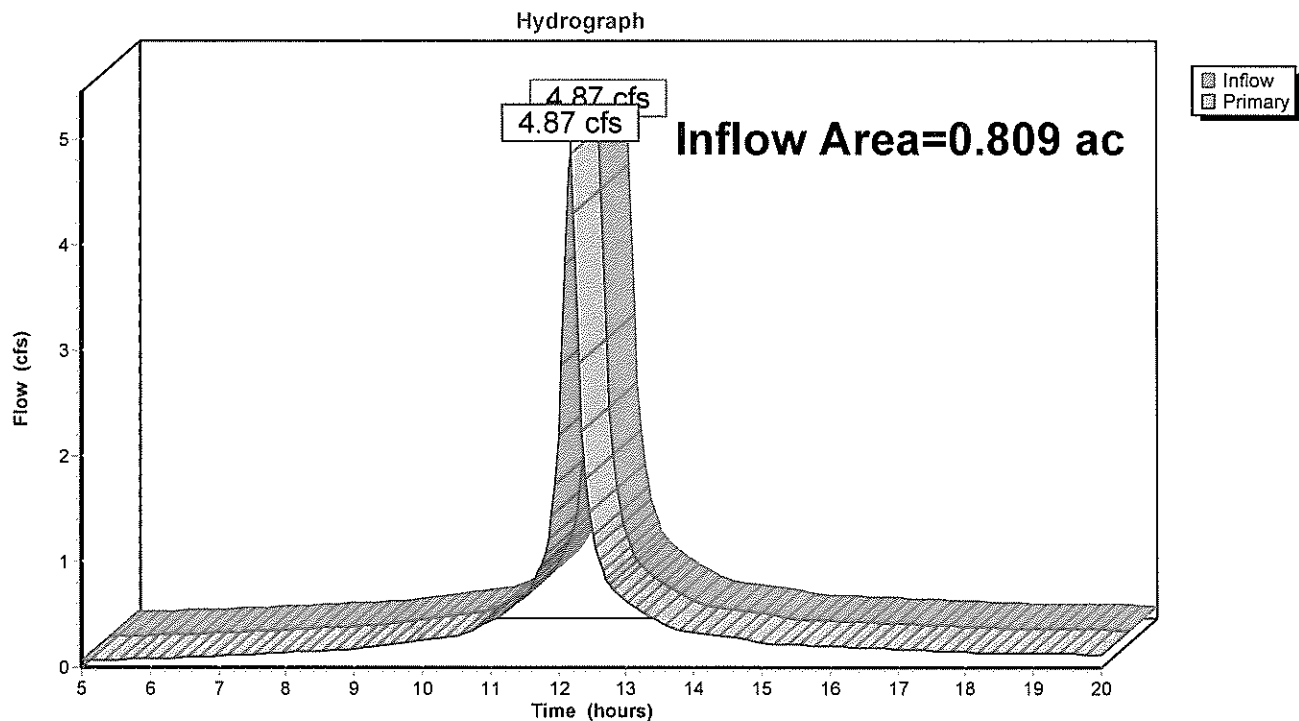


Summary for Link C-M.S.: Design Point - Current Conditions - Millbury Street

Inflow Area = 0.809 ac, 11.27% Impervious, Inflow Depth > 6.46" for 100-Year event
Inflow = 4.87 cfs @ 12.18 hrs, Volume= 0.436 af
Primary = 4.87 cfs @ 12.18 hrs, Volume= 0.436 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link C-M.S.: Design Point - Current Conditions - Millbury Street

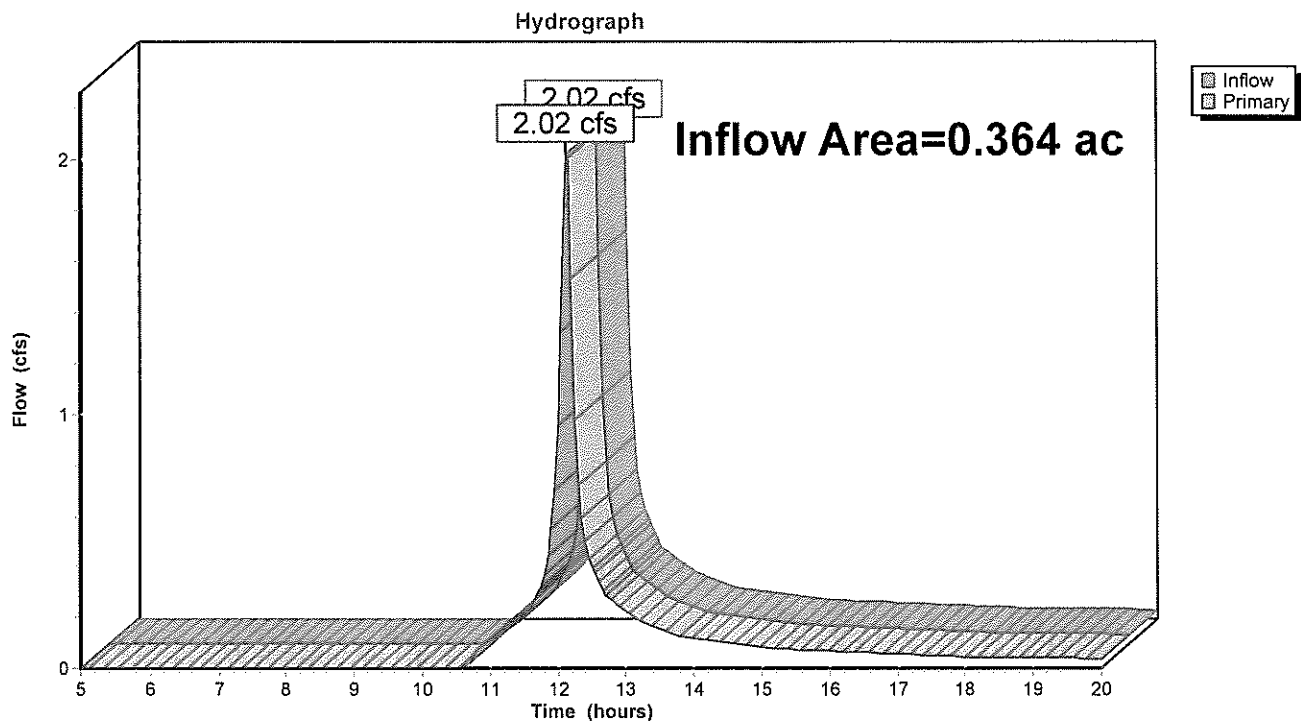


Summary for Link CB3: Design Point - Municipal Catch Basin in Millbury Street

Inflow Area = 0.364 ac, 0.00% Impervious, Inflow Depth > 4.06" for 100-Year event
Inflow = 2.02 cfs @ 12.14 hrs, Volume= 0.123 af
Primary = 2.02 cfs @ 12.14 hrs, Volume= 0.123 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link CB3: Design Point - Municipal Catch Basin in Millbury Street



Summary for Link MS: Design Point - Millbury Street

Inflow Area = 0.444 ac, 20.50% Impervious, Inflow Depth > 5.42" for 100-Year event
Inflow = 3.00 cfs @ 12.10 hrs, Volume= 0.201 af
Primary = 3.00 cfs @ 12.10 hrs, Volume= 0.201 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link MS: Design Point - Millbury Street

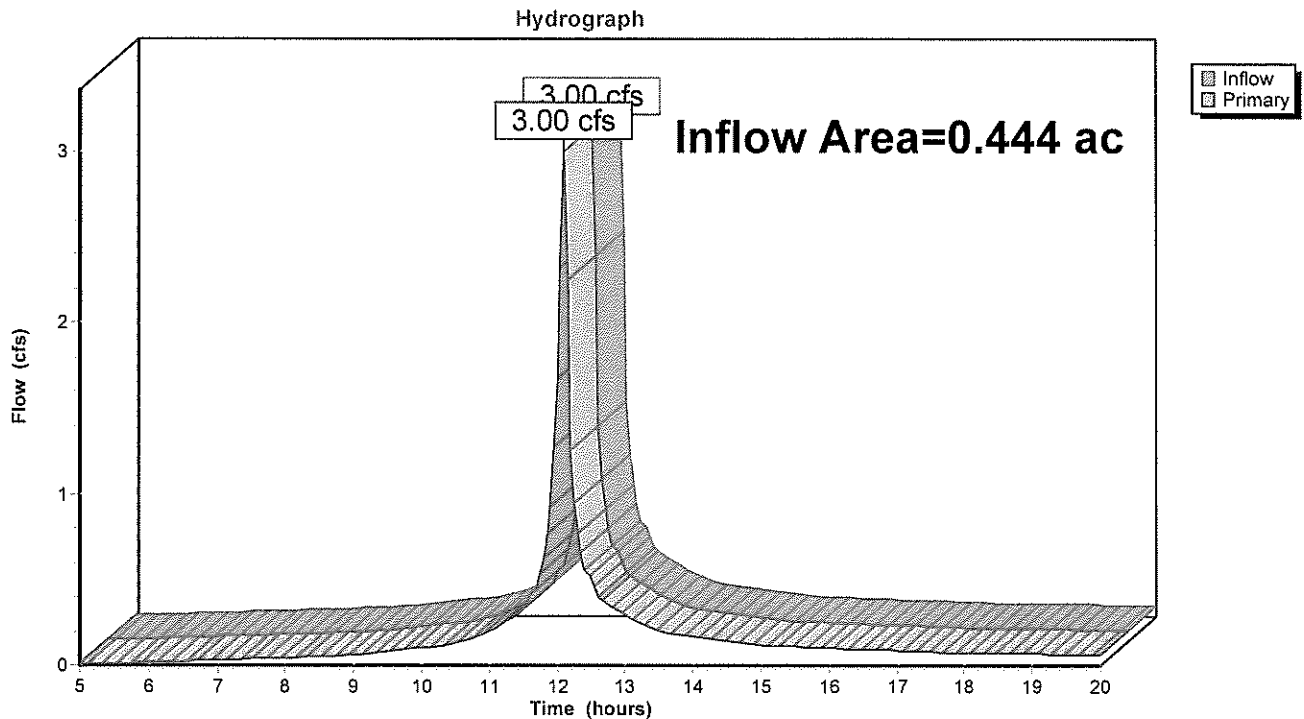


TABLE OF CONTENTS

Project Reports

- 1 Routing Diagram
- 2 Rainfall Events Listing (selected events)
- 3 Area Listing (all nodes)
- 4 Soil Listing (all nodes)
- 5 Ground Covers (all nodes)
- 6 Pipe Listing (all nodes)

2-Year Event

- 7 Node Listing
- 8 Subcat 1089: Current 2020 Conditions 1087-1089 Millbury St.TOTAL LOT
- 10 Subcat P-A: Poposed 2021 Conditions 1087-1089 Millbury St. Upper Section to Drain System
- 11 Subcat P-B: Poposed 2021 Conditions 1087-1089 Millbury St. Lower Section To Millbury Street
- 12 Reach DL: 12" D PVC Drail Line to CB2 in Millbury Street & Municipal Sewer
- 14 Pond CB1: Catch Basin 1
- 16 Pond CB2: Catch Basin
- 18 Pond IT: Interceptor?Recharge Trench
- 21 Link C-M.S.: Design Point - Current Conditions - Millbury Street
- 22 Link CB3: Design Point - Municipal Catch Basin in Millbury Street
- 23 Link MS: Design Point - Millbury Street

10-Year Event

- 24 Node Listing
- 25 Subcat 1089: Currrent 2020 Conditions 1087-1089 Millbury St.TOTAL LOT
- 27 Subcat P-A: Poposed 2021 Conditions 1087-1089 Millbury St. Upper Section to Drain System
- 28 Subcat P-B: Poposed 2021 Conditions 1087-1089 Millbury St. Lower Section To Millbury Street
- 29 Reach DL: 12" D PVC Drail Line to CB2 in Millbury Street & Municipal Sewer
- 31 Pond CB1: Catch Basin 1
- 33 Pond CB2: Catch Basin
- 35 Pond IT: Interceptor?Recharge Trench
- 38 Link C-M.S.: Design Point - Current Conditions - Millbury Street
- 39 Link CB3: Design Point - Municipal Catch Basin in Millbury Street
- 40 Link MS: Design Point - Millbury Street

25-Year Event

- 41 Node Listing
- 42 Subcat 1089: Currrent 2020 Conditions 1087-1089 Millbury St.TOTAL LOT
- 44 Subcat P-A: Poposed 2021 Conditions 1087-1089 Millbury St. Upper Section to Drain System
- 45 Subcat P-B: Poposed 2021 Conditions 1087-1089 Millbury St. Lower Section To Millbury Street
- 46 Reach DL: 12" D PVC Drail Line to CB2 in Millbury Street & Municipal Sewer
- 48 Pond CB1: Catch Basin 1
- 50 Pond CB2: Catch Basin
- 52 Pond IT: Interceptor?Recharge Trench
- 55 Link C-M.S.: Design Point - Current Conditions - Millbury Street
- 56 Link CB3: Design Point - Municipal Catch Basin in Millbury Street
- 57 Link MS: Design Point - Millbury Street

%%REV FULL PROPOSED_ 2021 -1089 Millbury Steet 09-22-21

Prepared by Alton Engineering

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Table of Contents

Printed 9/23/2021

100-Year Event

- 58 Node Listing
- 59 Subcat 1089: Currrent 2020 Conditions 1087-1089 Millbury St.TOTAL LOT
- 61 Subcat P-A: Poposed 2021 Conditions 1087-1089 Millbury St. Upper Section to Drain System
- 62 Subcat P-B: Poposed 2021 Conditions 1087-1089 Millbury St. Lower Section To Millbury Street
- 63 Reach DL: 12" D PVC Drail Line to CB2 in Millbury Street & Municipal Sewer
- 65 Pond CB1: Catch Basin 1
- 67 Pond CB2: Catch Basin
- 69 Pond IT: Interceptor?Recharge Trench
- 72 Link C-M.S.: Design Point - Current Conditions - Millbury Street
- 73 Link CB3: Design Point - Municipal Catch Basin in Millbury Street
- 74 Link MS: Design Point - Millbury Street